ENGINEERING NEWS

THE St. Paul *Globe* reports a test of the Westinghouse new triple-valve air-brake made at St. Paul, on Oct. 15. The test was made on a curve, with gradients of 31.6 and 52 ft. per mile, with a train of 50 box-cars of 60,000 lbs. capacity each, all equipped with the air-brakes, Janney couplers and Wagner doors. The total weight of train was over 950 tons. The first test was an "emergency stop," which was accomplished in 7 seconds, the train only moving 172 ft. after the brakes were applied. In the second test, the train moving at the rate of 36 miles per hour was brought to rest within 15 seconds, and a movement of less than 500 ft. With the train at a standstill the brakes were put on in 1½ seconds after the signal was given by electricity from the last or fiftieth car. On running down grade at 37 miles per hour, the brakes were next applied by the engineer at the signal post and a stop was made in 583 ft. or less than 20 car lengths. A "service stop" was then tried at a speed of 20 miles per hour, and only 35 lbs. of air were used on the brakes. When the train was broken in the middle, while running at 25 miles per hour, the rear portion stopped within 105 ft. With 20 cars only, and at a speed of 20 miles per hour the train was stopped in 109 ft. Another run at a 37-mile rate, was stopped in 327 ft. The last experiment was in the "skidding" or stopping of the train in the shortest possible time; and while under former practice 17 seconds was the shortest possible time in applying the brake on the last truck of a 50-car train, without the aid of electricity, the triple-valve did it in this case in less than 2 seconds. The whole test was very satisfactory in its results, and the *Globe* says that the many railroad men present "were dumbfounded at what they saw that day."

THE Chicago tests of the Westinghouse train, of Oct. 21, were equally startling and may be summarized as follows: Nine tests in all were made with a maximum speed of 40 miles per hour. In the "emergency test," at 22 miles per hour, a stop was made in 10 seconds with a run of 184 ft. only after the signal was given; in a second like test at 37 miles per hour, the record was 15 seconds and 480 ft. The third test was the application of the brakes by the engineer with the train standing still; the application to the whole train was so nearly instantaneous that no interval of time could be noted; the release of the brakes took 25 seconds. No electrical apparatus of any kind was used. The fourth test was made with passengers aboard and at a speed of 25 miles; the time was 11 seconds and the distance run after the brakes was set was only 162 ft.; at a speed of 34 miles the record was 15½ seconds and 470 ft. There was no jolting in either case, and the freight train came to a standstill as smoothly as the average passenger car in approaching a station. This feat opens up great possibilities to freight trains, in obviating the tremendous crowding of the rear cars of a train when the brakes are set on a few in front only; in doing away with the jamming of live stock and the damage to fragile goods, and lastly in the increased rate of speed possible for freight traffic. In the sixth test, or "service stop," the speed was 19 miles and the stop made in 1,000 ft., with only a part of the brake power applied as in an ordinary station stop. As a comparative test, the same train was stopped with the hand-brake in 1,200 ft. under unusually favorable circumstances. The seventh test was in breaking the train, and at 40 miles per hour the disconnected section stopped in 8½ seconds after traveling just 6½ car-lengths. Many railroad men and engineers witnessed the tests, and the great point made by the trials was that the new triple-valve Westinghouse brake could be applied to every car in a train 2,000 ft. long in just *two seconds*, while the same action was only previously possible in *fourteen seconds* under best conditions.

Mr. A. G. MENOCAL, Chief Engineer of the Nicaragua Canal Co., will start next month with eight engineering parties to locate the exact route of the Canal and to gather the exact data as to material, etc., that is required for final and accurate estimates on the canal work. He expects to finish this work in 8 months, and hopes the actual construction will begin about the same time. The total cost is now estimated at $65,000,000, subject to revision.

THE Panama Canal Co., according to late advices, is pursuing the new economical policy with vigor, and expenses are being cut down on all sides. It is said that little is being done save at Culebra, La Boca and Gatun. The machine shops at Bas Matuchin have been closed and 200 men discharged. The repair work is to be transferred to the Panama R. R. shops at Colon.

THE tunnel under the Harlem river for the New Croton Aqueduct is progressing slowly. The shaft for this work is of very considerable proportions, being 33×16½ ft. and 426 ft. deep. The original depth proposed was about 100 ft. less but, as before noted, the striking of a seam of disintegrated rock, carrying much water, about 300 ft. from the shaft, necessitated a deeper sinking. The shaft is now down on the south side and the drift under the river has been carried about 100 ft., but not yet far enough to be sure that the obstructing seam will not again be struck. If this point is passed in safety the tunnel will then rise at an angle to meet the bottom of Shaft 24 on the north side already sunk.

THE soil under the foundations of the Congressional Library, now under construction at Washington, D. C., has been tested in rather an original manner. Borings were first made over the site and the strata mapped out. Then the resistance of the ground in the bottom of the trenches was tested by a travelling car which was arranged, when halted, to bring its weight upon four cast-iron pedestals set 4 ft. apart each way. The car was loaded with pig-lead and the resistance of the soil, which was yellow clay mixed with sand, was found to be usually 13½ tons to the square foot. As the maximum load from the building will not exceed 2½ tons to the square foot, no after settlement is feared. This seems a very sensible way of settling a question that is too often left to luck.

IT is announced that Mr. GEORGE W. SMITH, a Buffalo inventor, is soon to test his theories on converting the powers of Niagara to a useful, commercial purpose. As roughly outlined in the Buffalo papers his scheme includes an endless chain with feathering buckets. He is said to be backed by a company with $1,000,000 capital, and to have sold the rights for Erie and Niagara counties for $65,000. The first machine is to be of 1000 horse-power and the Secretary of War has given his permission for the placing of the necesary works in the river.

THE New Jersey Central R. R. Co. is reported to be successfully using soft coal in its freight engines. This new departure is found economical and especially so as a substitute for the bad fuel it has lately been compelled to use as a result of the coal strikes.

THE work on the third and fourth tracks on the Pennsylvania R. R. between Jersey City and Philadelphia is nearing completion and the gaps are now few and rapidly closing up. At Menlo Park two reverse curves, the worst on the line, are being removed.

THE New York Central & Hudson River R. R. Co. has laid the 20 miles between Spuyten Duyvil and Peekskill with new 80-lbs. English steel rails. The old rail just taken up weighed 65 lbs. per yd. This rerailing is to be continued to Albany and Buffalo, says current report.

IT is reported that the recent decline in the price of steel rails was due to a combination on the part of some heavy buyers to withhold purchases for a time, which, combined with some discouraging rumors concerning the prospects for next season's work, caused the market to weaken. At a recent meeting of manufacturers, it was voted to shut down the mills for three weeks during the last quarter of this year and a similar time during the the first quarter of 1888. It is hoped by this means to keep up the price to $34 per ton, which figure will prevent foreign importations.

THE late tests of railway train telegraphy, by Mr. CHEEVER, President of the Consolidated Railway Telegraph Co., were very successful. The system is a combination of the inventions of EDISON, GILLILAND, PHELPS and SMITH. The results, briefly stated, were that on a train moving at a maximum rate of 60 miles per hour, on the Lehigh Valley R. R. messages were sent and received without difficulty transferred by induction through 20 ft. of air. Stock quotations were read on the train within 10 minutes after the closing of the Stock Board in New York. Passing trains were also communicated with, and by it all trains can be in direct communication with the dispatcher's office. This is the most satisfactory public test yet made of a system that must be of the greatest service to the public.

THE Pennsylvania Co. is said to be reducing the number of cars to be hauled by one locomotive and increasing the speed of the freight trains. Fully 50 per cent. of the cars they now haul on the Pennsylvania lines carry 50,000 to 60,000 lbs. for a car-load, and with the reduced number of cars there is more tonnage hauled on each train.

THE Minnesota Railway Commissioner falls mildly into line on the car-stove question and has addressed to all railroads in the State, a letter stating that in its last official tour the commission failed to find on a single car any form of fire extinguisher, although existing laws require "at least one fire extinguisher in each end of each car." The Commission threatens proceedings against all companies not so equipped before Nov. 1 next. It would be better still to extinguish the old car-stove and introduce a little compulsory law on the subject of the introduction of steam heat.

THE suit for the appointment of a receiver for the Cincinnati, Hamilton & Dayton Railroad Co. was granted by Judge VAN DERVEER, of the Ohio Court of Common Pleas, on Oct. 26. The decision was based on 18 findings of facts among which were: that while the assets of the company were about $8,500,000, the liabilities were $17,000,000; with guaranteed bonds and stocks amounting to over $13,000,000: and that $4,700,000 preferred stock had been hypothecated by Ives & Co. for their own uses. In view of these and other damaging facts the court granted the order restraining the present Directors from using the assets of the company to pay notes given by WM. RAMSEY and JULIUS DEXTER, and appointed as a Receiver Hon. JAS. E. CAMPBELL. The case was immediately taken by the defendants to the United States Circuit Court and a stay of proceedings was issued superseding and annulling Judge VAN DERVEER'S decision. The case will now be tried anew in the United States Circuit Court at Cincinnati.

THE following bridge accidents are reported: On Oct. 18, the bridge over Lawson's creek, on the Chesapeake & Ohio Railroad, near Paducah, Ky., was burned. The trains were flagged.——On Oct. 18, a trestle bridge on the Jefferson City, Lebanon & Southwestern Railroad, near Cooper, Mo., was wrecked by the derailed truck of a passenger train. One man was injured by jumping from the train. ——On Oct. 18, a bridge 50 ft. high, across Wolf creek, on the Leavenworth, Northern & Southern Railroad, gave way. One man was injured.

The most serious railroad accident of the week was a head collision between two freight trains Oct. 21, near Whiteside, Tenn., on the Nashville' Chattanooga & St. Louis Railroad. A Memphis & Charleston Railroad freight train which was put on the side track to allow another freight train, in three sections, to pass, pulled out when two sections had passed and collided with the third. Two men were killed and another seriously injured.——On Oct. 23, the brakes on a train entering the depot of the Delaware, Lackawanna & Western Railroad at Hoboken, N. J., refused to act; the train ran into two Pullman cars and drove them into the office of the Pullman Car Co., wrecking the cars and the office. The engineer was killed and another man injured. The cars took fire from the stoves, but the flames were extinguished by the fire department.

On Oct. 21 a misplaced switch at Brushtown, N. Y., on the Ogdensburg & Lake Champlain Railroad, ditched 10 freight cars, causing considerable delay to traffic.

THERE has lately been erected on the Cape de la Heve, near Havre, France, a plant for producing and storing electricity by aid of the wind. The plant includes a Halliday wind-mill of 20 horse-power and the two dynamos especially designed for this purpose by the DUKE DE FELTRE, who is the parent of the scheme. The practical and economical value of this combination has yet to be tested.

ENGLISH engineers at last condescend to adopt a certain form of "cow-catcher" on the motors for steam tramways in Birmingham. But not seeing fit to model the affair after American ideas, this cow-catcher was fitted with wheels "revolving upward," so that an obstacle could be picked up and thrown out of the way. The late tests did not prove the thing to be a success, and at 8 miles per hour it was valueless. This invention was brought out by the late loss of life on the Birmingham steam tramway, and the letter of the Public Works Committee of the Corporation to the company demanding that "the safety of the public must stand before everything in the working of the line;" and unless it is possible to prevent loss of life, the withdrawal of permission to use steam must follow. There were only 5 deaths to 25,000,000 passengers in the last year; but this year's record raises the average to one death in 3,000,000 passengers, and the Corpora- is becoming alarmed.

A Trans-African railway is the latest, and the subject is being earnestly discussed by the Cape Government and the two Boer States. There is already a railroad from Cape Town to Kimberley, 650 miles long. This brings the line to within 50 miles of the borders of the Orange Free State and the Government is now willing to spend $14,000,000 on the 400 miles of railroad across this territory. A further extension of the road across the Transvaal and a narrow strip of Portuguese territory would bring the line to Delagoa Bay on the East coast and from which point a railroad is already projected. One of the chief ends in view in this project is the better welding together of the conflicting English and Dutch elements in South Africa.

A PHILADELPHIA correspondent of the N. Y. *Times*, who professes to know of what he speaks, sketches out as follows the railway system contemplated in the Barker-Chinese syndicate:—According to a map said to be in the possession of the Viceroy, LI HUNG CHANG, the route would extend from Pekin, *via* the Grand Canal, to Shanghai, bends inward along the Yang tse-kiang, and finally reaches the sea-coast again at Canton. With its laterals it would amount to nearly 3,000 miles of railroad. If this route is anywhere near correctly projected it crosses nearly the whole Chinese Empire from north to south, and gets into some seemingly very mountainous country between the valley of the Yang-tse-kiang and Canton. It is ambitious enough, and would doubtless be a good datum-line for the future railroad system of China, but we will probably wait a little while before it is completed.

DR. HECTOR GEORGE, in an article in *Le Genie Civil* on venomous animals, says that alcohol used as an antidote for the venom of snake-bites should be hot, as in addition to certain qualities of its own the production of a copious perspiration is beneficial and seems to remove some of the poison through the skin. Singularly enough the Italian peasants long ago discovered that the poison of the enormous spiders of Tarentum could be eliminated in this way, and from this belief we have the mad Tarantula dance that has commonly been attributed to the effect of the poison, instead of which it is a vigorous effort of the victim to work himself into a profuse perspiration and so rid himself of the effects of the venom. In this connection it might be remarked, even at the risk of being accused of puffing a patent medicine, that in Mexico the Perry Davis Pain-Killer is in universal use as an antidote to the poison of the many venomous animals and insects of that region. Ammonia is also frequently used, and both the ammonia and the pain-killer produce a profuse perspiration, thus agreeing with the Italian remedy in its manner of eliminating the poison through the skin. In almost every Mexican hut, even in the remote regions of the country, will be found a bottle of the Perry Davis remedy, and it is applied to beast as well as man in the case of a bite from a tarantula or other venomous insect.

The Poughkeepsie Bridge; Its Foundation and Substructure.

The Poughkeepsie bridge is now being erected by the Union Bridge Co., of New York, for the Manhattan Bridge Co. and crosses the Hudson river at a point about 75 miles above the City of New York. When completed it will, in connection with a railroad yet to be built, form an all rail route between the Pennsylvania coal fields, and points west, and the New England States, being the only railroad bridge crossing the Hudson south of Albany.

The early history of this enterprise, as gathered from a number of sources, is as follows: The Hudson at this point is 2,600 ft. wide and the topography of the country on each side is such as to permit the location of a railroad approach with gradients of 66 ft. per mile. The project of bridging the river at this point was virtually started in 1871 and many plans were suggested, including a suspension bridge, to meet the objections and powerful influence of the river men. In 1872 the late JAMES B. EADS was consulted in regard to the matter; he declared against a suspension bridge and recommended truss spans of 500 ft. in the clear as the best plan for adjusting the conflicting interests. A charter was finally obtained on this basis, and in 1873 the Pennsylvania R. R. Co. took a controlling interest in the enterprise which was estimated to cost about $2,000,000. The plan as finally elaborated included four river and two shore piers of masonry and five double-intersection Pratt trusses of 525 ft. span each, *c* to *c*.

On Jan. 20, 1875, the Poughkeepsie Bridge Co., with Mr. P. P. DICKINSON as Chief Engineer, entered into a contract with the American Bridge Co., of Chicago, with Mr. W. G. COOLIDGE as Chief Engineer, for the completion of the structure. Under this contract work was commenced on Piers 2 and 3 (Fig. 1), the plans for overcoming the difficulties of the deep foundations required having been devised by Mr. COOLIDGE. Owing to financial difficulties and other complications resulting from the death of Prest. THOMSON of the Pennsylvania R. R. Co., work was abandoned in September, 1878. At this time Pier 2 was built up 20 ft. above high water, and Pier 3 was sunk through 55 ft. of water and 40 ft. of mud, and the top of the crib was about 1 ft. above high-water. The masonry pier had been started on Pier 2; the plans adopted will be hereafter described.

Nothing further was done upon the bridge until last year, when the Manhattan Bridge Co. was organized and acquired all the rights of the previous company. This new company made a contract with the Union Bridge Co. for the entire work of foundation and superstructure, and on this contract operations were commenced in September, 1886. In the new plans now made, the charter requirements of 500 ft. clear channel openings and a clear height of 130 ft. below bottom chord were of course still adhered to, and the two foundations partly completed were to be utilized, and the new foundations sunk in similar open cribs, with considerable modification, however. But the piers and superstructure were entirely changed. For the solid masonry piers of the old plan metallic towers resting on stone piers, 40 ft. high, were substituted, and the superstructure was changed to two connecting and three cantilever spans as shown in Fig. 1, with the rails 212 ft. above high-water. The dimensions of these spans were also controlled somewhat by the change in conditions on the west bank where the West Shore R. R. now has its tracks.

At the bridge site the river is 3600 ft. wide with a depth of water ranging from 50 to 60 ft. The general character of the bottom is shown in Fig. 1; it was made up of a fine, soft mud and clay and sand mixed to a depth of at least 100 ft. below high water, when a firm, hard sand and gravel stratum was met with overlying the bed-rock, which latter was about 140 ft. below high-water mark. In the following description of the methods used for founding the piers under these difficult circumstances and for some detail of the troubles met and overcome, we are indebted for our data to an excellent paper prepared for the American Society of Civil Engineers by Mr. J. F. O'ROURKE, the Chief Engineer for the Union Bridge Co. and in charge of the new work from its first surveys last year. In this connection it might be remarked that some exceedingly close and satisfactory triangulation work and pier location has been done here by Mr. O'ROURKE; but we will leave the interesting description for another issue and at present deal with the foundations alone.

Plate I, (Figs. 1 to 6), gives the general design of the foundation cribs, the floating caisson and the masonry pier. While the general design of the timber crib is the same as in the original plans of 1875, it is modified in essential details and a floating caisson is substituted for the continuation of the crib as a coffer-dam at top, in which to build the masonry. Gravel was used in the weighting pockets of the new cribs instead of concrete as in the old.

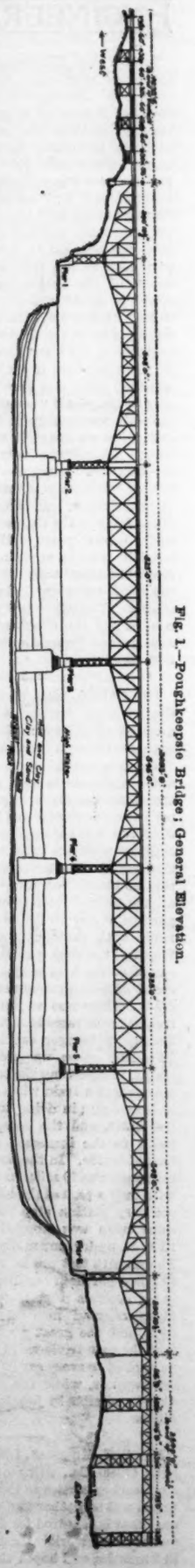


Fig. 1.—Poughkeepsie Bridge; General Elevation.

Commencing with the crib, which is 60 ft. wide by 100 ft. long at the bottom, we have for the first 20 ft. in height a cutting-edge made of solid timbers and shod with a 12×12 in. oak stick. All the timber used in the crib was 12×12 in. hemlock, saving the oak shoe before referred to. These triangular portions close the bottoms of the pockets to be used in sinking the crib through the mud, etc. and holding it down against flotation. Above the cutting edge the walls of the pockets were made of two thicknesses of timber, or 2 ft. wide. These longitudinal walls were firmly tied together by six cross, walls (not including the end-walls) each 2 ft. thick also and starting just above the oak shoe. An inverted plan of this framing is shown in Figure 4, Plate I, in which the 14 clear openings, each 10×12 ft., represent the dredging pockets through which all the material was removed by a clam-shell dredge as the crib was sunk by the weight in the central and side pockets. The 12×12 in. timbers were so laid that the longitudinal and cross courses alternated in direction, and the spaces between in each case were closed with fillers of the same timbers. All halving or jointing of sticks was thus avoided and the entire mass was thoroughly tied in each direction, with solid walls from bottom to top. Each course was fastened to the one below by round 1-in. drift-bolts, 30-in. long with 425 bolts to each

full course. As the old bridge company had had some serious trouble from the lifting of a part of the crib by the buoyancy of the timbers, careful experiments were first made by the present builders as to the value of a drift-bolt under these conditions. It was found that a 1-in. bolt driven into a $1\frac{1}{4}$-in. hole required a force of 423 lbs. per lin. in. of bolt to withdraw it; with this as a base the number required was determined and this number was made uniform for all the courses, allowing an ample margin of safety.

The actual sinking of the cribs to hard bottom was accomplished by dredging, under the usual conditions of such work, the cribs hanging for a time and then descending with a drop of some feet at a jump, settling more or less out of level in either direction. Mr. O'ROURKE, we understand, introduced some very practical modifications in the dredging practice which resulted in the better maintenance of the level of the crib in sinking. When hard bottom was at last reached the dredging pockets were filled with

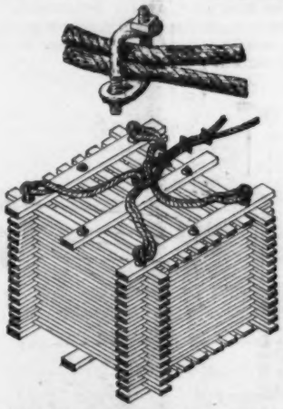


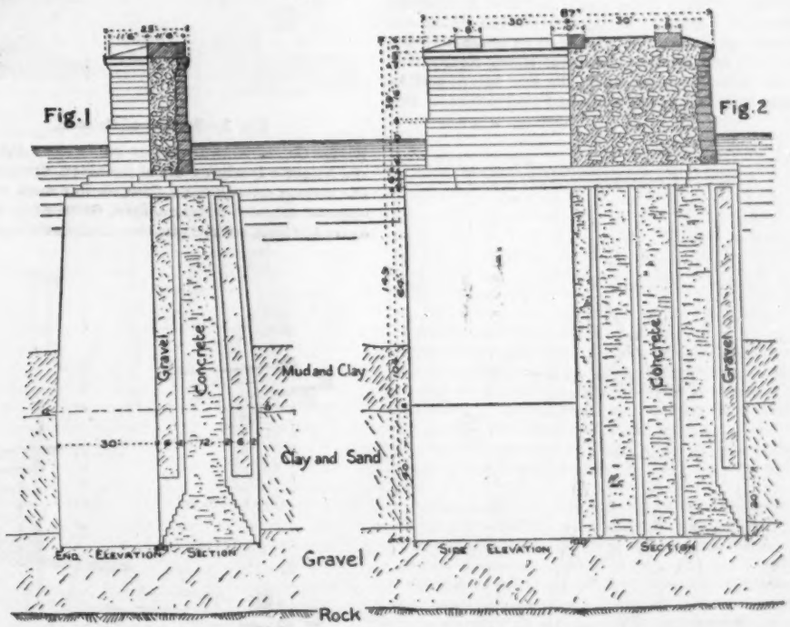
Fig. 2.—Chinese Anchor and Cable-Clip.

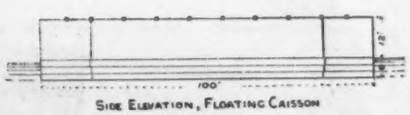
concrete deposited under water by boxes holding one cubic yard each and opened at the bottom by a latch and trip-line. This concrete was made alongside the crib on a float especially fitted. This float carried a raised mixing platform with the concrete mixer (made by the Cockburn Barrow & Machine Co. and described in our issue of March 5, 1887) set beneath; cranes on this float handled the boxes and deposited the concrete at a maximum rate of 300 cu. yds. per day, which is an almost unequalled rate of progress. It should be remarked that before this concreting the weighting pockets had been solidly floored over with 12 in. timbers and the concrete was levelled off within them by the aid of divers.

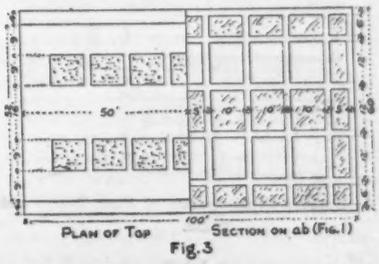
The floating caisson which surmounts the crib and carries the masonry on its 6 ft. deck resting upon the latter, is shown in Figs. 5, 6, Plate 1. The general dimensions are there given. The bottom of the caisson is 6 ft. deep made of 12 in. timbers laid in three 2 ft. steps or courses. The sides are double layers of 2 in. plank, caulked on the outside, with the angles pitched, covered with canvas and battened. Holding-down bolts and top cross-girders permit the sides to be removed as soon as the masonry is above the water sufficiently. The caisson is towed out over the crib and the masonry started, and when it will only float at high water (for the tide reaches this point in the river) it is exactly located and sunk to a final bearing by additional weight.

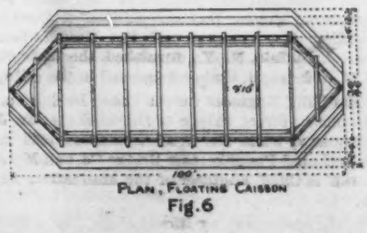
The piers are very handsome in design, and are built with a face of a dark limestone laid in magnificent courses of 3 ft. and upwards in depth, and the interior filled with concrete. The surmounting coping is very pleasing in its effect with just enough tool-work upon it not to detract from the mass and position of the pier.

This completes the general description of the foundations, and we now come to some of the difficulties of the work. The first trouble was found at Pier 2. Here the old bridge company had completed the foundation, and had built its masonry pier to a height of 20 ft. above high water, with top dimensions of 22×68 ft. This was not a sufficient base for the metallic towers of the Union Bridge Co., which called for dimensions of 25 × 87 ft. and the old masonry had to be taken down and the pier widened and lengthened somehow. But the old company had had trouble here too, and it came about in this way:—In the old crib the upper eight courses had been caulked, and a coffer-dam commenced upon it, and carried down with the crib until its bottom was 38 ft. under water. When this dam was pumped out, the upward pull proved too great for the holding power of the combined bolts and concrete, and the whole mass lifted several feet at the north end, hinging at the south. It came down again when water was admitted, but the bolts and debris prevented a closer fit than 8 in. In this emergency a pneumatic caisson, 29×74 ft. in size was used to secure a bearing on the solid part of the









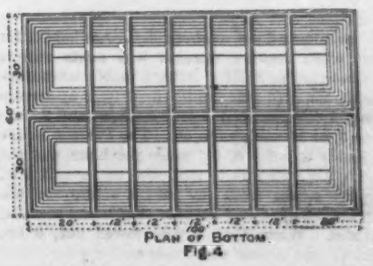


Plate L—Figs. 1-6. Poughkeepsie Bridge

limits of the old pneumatic caisson, excepting only two end sections which carry no weight, and the old 8 in. rupture was boarded up tightly and Portland cement was injected through six 3 in. standpipes left for that purpose.

At Pier 3, all rotten timber in the upper courses was replaced by sound sticks, and the dredging recommenced until its bottom was 126 ft. below high-water. The center of this crib was found to be 5 ft. east of its proper positions, but as the crib is 60 ft. wide and the masonry only 25 ft. wide, this fact gave no trouble.

foundation, and as a consequence the masonry was started 23 ft. below high-water.

The Union Bridge Co. was thus compelled to sink a coffer-dam, 43×96½ ft., around the old caisson and masonry, and resting on the old crib at a point where its dimensions were 50×100 ft. This coffer-dam was made of two walls of 12×12 in. timbers with verticals of the same size between, and the pockets thus formed were filled with concrete for 16 ft. in height and finished out with clay. Mr. O'ROURKE says this last was a mistake, as it could not be rammed, and gave them trouble from leakage. The bottom of the dam was filled by the assistance of divers with concrete, made with 2 parts of cement, 3 of sand and 6 of screened gravel. The masonry for the present pier is erected within the

Piers 4 and 5 were entirely new and in mid-channel, and it was found to be a very difficult feat, at first, to hold them to their anchorage before grounding. Commencing with Pier 4, we have a weight to handle of about 5,000 tons, in an unwieldy form, and presenting an outside vertical area to the river current of 17,000 sq. ft., with several thousand additional square feet in the inside walls. The crib drew 59 ft. of water, and it was at first proposed to hold it by three up and three down-stream anchors, of the form shown in Fig. 2, with smaller anchors at the four corners.

These Chinese anchors, as they are called, were boxes made of 3×8 in. plank, 9 ft. long, enclosing a clear space of 6×6×6 ft. They held 8 cu. yds. of broken stone, weighed 14 tons in the air, and were

tied together by 1¼ in. eye-bolts at the corners, and four other bolts, as shown. Through the eye-bolts passed slings of 7 in. rope protected with sail cloth to stop chafing and uniting in an iron thimble to which the anchor cable of wire-rope was attached. These anchors were set upon inclined ways on a scow, filled with stone at the shore, and the scow towed out into position and the holding rope cut and the anchor dumped where wanted; the wire cable was then carried to the crib.

But when it came to anchor Crib 4, in a spring freshet and unusually high water, it was found that the six weighted boxes would not hold it, and the crib easily dragged anchors and steamers down-stream; it broke a 9 in. hawser in an attempt to get it back, and grounding several times finally traveled about 3 miles before the tide turned and it could be brought back again and tied to Pier 3. On

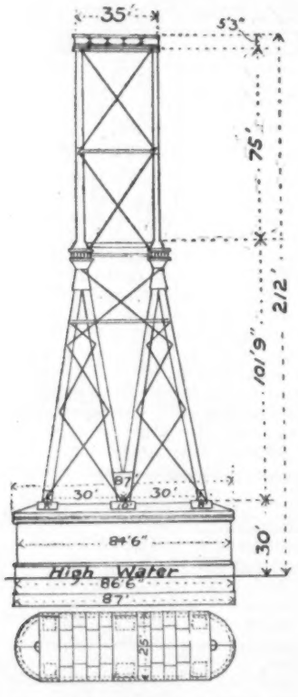


Fig. 4.—General Cross-Section of Pier, Tower and Truss.

April 11, 5 anchors were put out up-stream and as many down, but the crib again dragged the upper anchors after first parting two cables by the surging of the crib; the 5 down anchors, however, held it for 3 days, when another attempt was made with a somewhat similar result. After a fourth unsuccessful trial, the crib was finally held by 8 up-stream anchors, 3 down-stream, 5 side anchors and 2 lines to Crib 3, or 18 anchors in all. The current in the river had a velocity of 2½ miles per hour, and the effect on the crib was to sink the upper end 2 ft. under the strain from the cables, while the unwieldy mass surged in a manner that broke many of the cables. When Crib 5 was towed out, 8 up-stream, 6 down-stream and 8 side anchors were used to commence with, and the work of location was accomplished without any particular trouble.

The dates of progress, under the contract of the Union Bridge Co. on the several piers, would stand as follows:

Union Bridge Co. commenced work	Sept.		1886.
PIER 1. Foundations commenced	Oct.	8,	"
Pier masonry finished	March	17,	1887.
PIER 6. Foundations commenced	Dec.	6,	1886.
Pier masonry finished	Feb.	17,	1887.
EAST & WEST ANCHORAGE finished by	May	9,	"
PIER 2. Pier masonry commenced	June	20,	"
do finished	Aug.	12,	"
PIER 3. Concreting commenced	June	10,	"
do finished	July	16,	"
Caisson towed out	Aug.	4,	"
Pier masonry commenced	Aug.	5,	"
do completed	Sept.	17,	"
PIER 4. Dredging commenced	May	20,	"
do finished	July	27,	"
Concreting commenced	July	28,	"
do finished	Aug.	20,	"
Caisson towed out	Sept.	3,	"
Pier masonry commenced	Sept.	9,	"
do do finished	Oct.	20,	"
PIER 5. Dredging commenced	June	9,	1887.
do finished	Aug.	20,	"
Concreting commenced	Aug.	22,	"
do finished	Sept.	16,	"
Caisson towed out	Sept.	28,	"
Pier masonry commenced	Oct.	5,	"
do do at H. W. mark	Oct.	15,	"

The entire work is being done by the Union

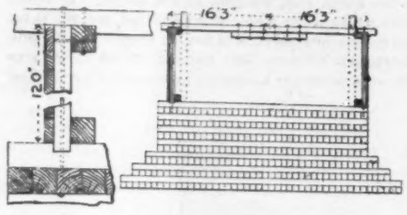


Fig. 5.—Section of Caisson.

Bridge Co., of New York, but under their direction the Atlantic Dredging Co. of Brooklyn, dredged out the various cribs, having done similar work for the original company; Messrs. ROSS, SANFORD & BAIRD drove the long, spliced piles required and erected the false works and are putting up the entire superstructure; Messrs. DAWSON, SYMMES & USHER, are building the masonry and the United Lumber Co., of Buffalo, N. Y., furnished the 12,000,000 ft. B. M. of hemlock timber consumed in the cribs, etc.

The Chief Engineer for the Union Bridge Co. and the one in direct charge of the works is Mr. J. F. O'ROURKE, while Mr. P. P. DICKINSON still represents the old Poughkeepsie Bridge Co, and Mr. A. B. PAINE is Chief Engineer of the Manhattan Bridge Co.

In the accompanying illustrations, Fig. 1 shows a general elevation of the river crossing, the shore viaducts being only indicated in part. Fig. 2 represents the anchor described and also a very reliable form of clip used in fastening together parts of the wire anchor cables; it is very simple and needs no explanations. Fig. 3 is a plan and elevation of the anchorage adopted for Pier 5, showing the points of connection for the cables and relative position of the anchors. Fig. 4 is a general skeleton elevation of the metallic towers and a cross section of the connecting truss; showing general dimensions; we expect to give later the detail of this very interesting piece of truss construction. Fig. 5 is a cross-section of the caisson with some detail of the construction.

Plate I, Figs. 1 to 6, are already described. In closing this description we would again express our obligations to the Union Bridge Co., and to Mr. O'ROURKE especially, for courtesies shown in connection with this work.

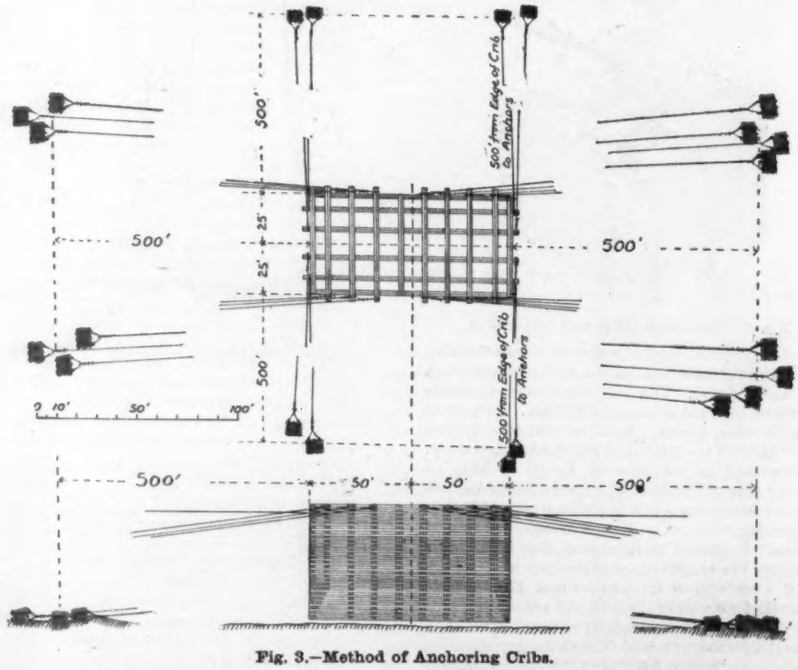


Fig. 3.—Method of Anchoring Cribs.

Wind Pressure and Velocity.

In a letter to *Science* by H. ALLEN HAZEN, of Washington, D. C., we find the following interesting notes on wind pressure and velocity:

There have been two methods of experimentation; the earliest, with plates rotated upon an arm seldom exceeding 10 ft. in length, and, later by the exposure of plates to direct air-motion. BORDA, in 1763, with plates ranging from 16 to 85 sq. ins. area, obtained the following relation $p = (.0231 + .00035\ c)\ S v^2$, in which p = pressure in pounds on the plate, c = contour of plate in feet, S = surface in square feet, and v = velocity in miles per hour (this notation will be maintained throughout.)

In 1874, HAZEN tried most careful experiments with an arm of 8 ft. The velocity ranged from 1 to 8 miles per hour, but the room was so small that at the latter velocity the air was set in feeble rotation. The plates ranged in size from 4 to 40 sq. ins. He found, as did BORDA, that the pressure per square foot increased with the size of the plate. The following is the relation established by him, $p = (.002894 + .0001403\ c)\ S v^2$. This formula for this relation has repeatedly appeared in print, and each time it has been changed. This is believed to be correct.

Singular as it may seem, these experiments have been almost the only ones quoted in discussions of this question, and yet it is easy to see that they are utterly useless for determining the pressure of a 50-mile wind on the side of a building.

In November, 1886, a few experiments in Washington with an arm of 4 ft., and plates from 16 to 576 sq. ins. area, gave the relation $p = (.0032 + .00034\ c)\ S v^2$. The agreement with BORDA's results is very interesting.

Afterwards, with the same style of apparatus and an arm of 16 ft., the relation found was $p = .0034\ S v^2$. The velocity of the larger plates was only 4 miles per hour, so that this formula does not help us for greater velocities. It was certainly established that there was no difference in pressure per square foot depending on the size of the plate. Turning to experiments of the second class, we find that THIBAULT obtains, with plates from 1 to 1.5 sq. ft. area exposed to the wind, the relation, $p = .00475\ S v^2$. In France, with plates exposed on a locomotive running 44 miles per hour, the relation established was $p = .00535\ S v^2$. In this case, probably, a slight allowance must be made for the wind with the train.

In the "Encyclopædia Britannica," article "Hydromechanics," the mean of all the better determinations is $p = .00496\ S v^2$.

We may conclude, 1st, that experiments with whirling arms of less than 16 ft. are very untrustworthy; 2d, that we need determinations with rapid, straight-line motion, best obtained, perhaps, by pushing two or three platform-cars loaded with iron in front of a locomotive exposing the plates on the front car; 3d, the relation $p = .005\ S v^2$ is the most satisfactory yet determined and does not differ by more than 4 or 5 per cent. from the truth.

While there has been this great difficulty in determining the above relation, there has been just as much, if not more, in connection with the relation between the velocity of the wind and that of the cups of ROBINSON'S anemometer. Some confusion has arisen from the fact that the standard anemometer in England has 9-in. cups and 24-in. arms, while in our country we have 4-in. cups and 7-in. arms.

It has been determined, by careful experiment in England, that, if the large type of anemometer has a factor of 2.5, then the smaller should certainly have 3.00. Dr. ROBINSON, after a long research with a whirling machine, decided that the factor (of the smaller instrument probably) should be about 2.5. After trying a few experiments in the open air, however, he changed his view, and decided that the factor should be 3.00. In Washington, with an arm of 16 ft., and a velocity of 12 miles per hour, the factor was found to be 3.00.

Quite recently the Chief Signal Officer, through the kindness of the officials, as a preliminary to carrying on experiments on platform-cars, as suggested above, has had an anemometer placed upon a locomotive of the Baltimore & Ohio Railroad running from this city to Baltimore. Only one round trip has been tried thus far: in the outward trip the velocity of the train was about 20, and returning it was about 46 miles per hour. Allowing for the actual wind, we find the anemometer indication 46 miles going, and 47 returning. The distance was 40 miles, and we may consider that the excess of about 6 miles was due to the heaping up and flowing over of the air in front of the locomotive. All things considered, it seems probable that the factor 3.00 now used in our anemometer of 4-in. cups and 7-in. arms is entirely correct: certainly no change in the present factor can be thought of for an instant. A complete discussion of this question has already been prepared by me, and will appear later. The other side of this question has been recently presented by Prof. FERREL in the August *American Meteorological Journal*.

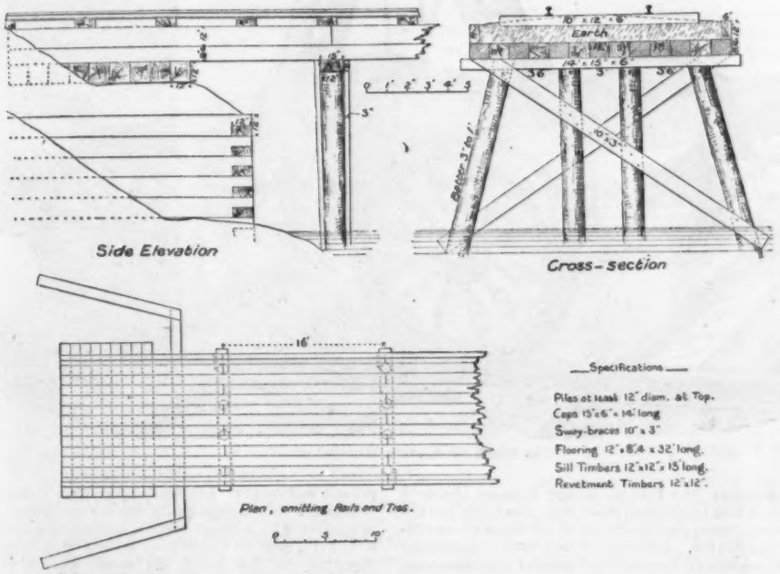
A Novel Trestle Work.

Mr. WALCOTT C. FOSTER, late an engineer with the M. & D. J. R. R., sends us a sketch and short description of a novel form of trestle work used "very extensively" on the Louisville & Nashville Railroad.

As described, the timber used in these trestles is a thoroughly creosoted yellow pine, and simply spiked together without a mortice or tenon in the structure. The ties used, are, in this case, sawn, though of course ordinary hewn ties could be employed just as well.

The advantages claimed for this special arrangement, over ordinary forms of trestle work, are as follows: A continuous earth roadbed which obviates the jar usually felt in passing from an embankment to a timber structure and consequently decreases the wear and tear on the rolling stock. The hollow, rumbling sound observed in passing over the regulation trestle, and which is so disagreeableto passengers, is entirely destroyed in the form illustrated. The danger from fire from dropped cinders is reduced to a minimum, and the last is probably the chief practical advantage. The creosoted yellow pine is practically proof against decay, and no trouble has so far been observed by the fact of having earth in contact with it.

This form of trestle would probably be less durable in a northern climate, as the moisture in the filling, by freezing and expanding, would exert an injurious rending effect upon the structure. But in regions where the frost never penetrates more than an inch or so below the earth's surface, it is found to work admirably.



A Novel Railroad Trestle.

Neutral Axis in Unsymmetrical Sections.

Written for ENGINEERING NEWS.

BY THOS. H. JOHNSON, Prin. Asst. Eng., P. C. & St. L. Railway Co.

To question the accuracy of old and well recognized authority, may be presumption, but without such question there can be no progress. I therefore venture to call attention of engineers to an error in the prevailing method of finding the neutral axis, and moment of inertia of unsymmetrical sections.

All acknowledged authorities assert, or imply, that the neutral axis is, in all cases, upon a line which passes through the center of gravity of the section, and the almost universal practice among bridge engineers follows this teaching. A method of finding the neutral axis of unsymmetrical sections, in very common use, consists in balancing a templet of the section over a straight edge. The line so found must of necessity pass through the center of gravity, and will be the neutral axis of the gravitation forces acting on the templet, because it is the line, about which, the forces, then acting, are in equilibrium. But it cannot be the neutral axis of bending moments for the reason that it is not the line about which the bending moments upon either side are in equilibrium.

The force of gravity acts with equal intensity upon each unit of area of the templet. The moment of this force for any one unit area will be the product of the force by its distance from the line of support.

For bending moments, the forces acting on the section are not uniform; but vary from tension on one side to compression on the other; the intensity of the force at any point being proportional to the distance of that point from the neutral axis. The intensity of the force will then be some function of the distance, and its moment will be a function of the *square* of the distance.

It is evident, therefore, that each unit area will have widely different values in the two cases, and hence both sets of forces cannot be equilibrated by a common neutral axis.

"In the little book on "Wrought-Iron and Steel in Construction," issued by the Pencoyd Iron Works, and which, I believe, is the work of Mr. JAS. CHRISTIE, Mem. Am. Soc. C. E., it is stated (p. 35) that in unsymmetrical beams the moment of inertia taken about an axis through the center of gravity, "*does not give results in harmony with experiments*," but that "by taking the moment of inertia above and below an axis, so located that the forces producing tension and compression are in equilibrium, *results harmonizing with experiments are obtained*."

So far as the writer is aware, this is the only instance in print where the accuracy of the prevailing practice is questioned, and the correct practice indicated.

The remarks quoted were written with special reference to *beams*, but the true position of the neutral axis is of far greater importance in the location of pin centers in compression members of bridges. This is well illustrated by a series of four experiments on columns made at the Watertown Arsenal (p. p. 164 to 168 Senate Doc. No. 5., 48th Congress.)

Four columns were made, each of two 10 in. channels with $\frac{7}{16}$ in. cover plate on one side, and latticed on the other. Two of these were tested with pins in the line through the center of gravity of the section, and with two pins in centers of channels. The first two failed under strains of 26,190 lbs. and 28,150 lbs. per sq. in. The second pair failed under unit strains of 17,270 lbs. and 17,420 lbs. respectively.

The second pair gave results averaging 36 per cent less than the first pair, which shows the importance of due attention being given to the position of the pin center. But these experiments also furnish evidence that the line through the center of gravity is not the true neutral axis, and hence in neither case was the full strength of the column realized in the test.

Going back to the difference between gravity forces and bending moments, a little consideration will show that to equilibrate the gravity forces will require the neutral axis to be moved farther from the side of the smaller area, than is needed to equilibrate the bending moments, because, in the latter case, the moment varying as the square of the distance, the smaller area upon one side will the more readily equilibrate the larger area upon the other side. The center of gravity will always, therefore, be farther from the center of depth than the true neutral axis.

Hence in the Watertown experiments, the true neutral axis was intermediate between the two positions of the pin centers. In the first two columns, the applied force must have acted with a leverage on the side toward the cover plate, and in the others toward the latticed side. In the tests, the first two columns deflected *concave on the plate side*, and the latter two "*concave on the latticed side*." Thus furnishing experimental evidence of the correctness of our theory.

In the first two tests the pin centers were placed 1.63 in. and 1.54in. from center of channels, the average being 1.58 in. The true neutral axis for those sections would be at 1.05 in. from the center of channels. With the pins through the center of gravity, the leverage of the applied force was 0.53 in. and with the pins in center of channels 1.05 in. or almost exactly twice as great.

In the present state of our knowledge, it is impossible to say in what ratio the eccentricity of the bearings affects the ultimate strength. If the effect is proportional to the *square* of the eccentricity, then the full strength of these columns properly centered would be 30,440 lbs. per sq. in., and the eccentricity caused a loss of strength of 10.8 per cent in the one case and 43.6 per cent. in the other. If the effect is *directly* proportional to the eccentricity the full strength of the columns would be 36,990 lbs. per sq. in., a loss of 26.6 per cent with pins in center of gravity, and 52.2 per cent with pins in center of channels. If these columns had been designed for service in a bridge, and the strength computed by the formula on page 530 of the Transactions for 1886, the estimated strength would be 32,460 lbs. per sq. in. and the erroneous placing of the pin centers would cause a loss of strength, of 19.5 per cent in the first instance, and 46.5 per cent in the second instance.

These figures make it clear that the importance of the subject is too great to allow the present practice to longer pass unchallenged. And it is hoped that enough has been said to call forth such full and free discussion of subject, as will either reform the practice or convince the writer that he is in error.

The Sheffield Section Hand-Car.

We illustrate the Section Hand-Car which was so highly recommended by the New England Road Masters' Convention, as noted in our report of that meeting on page 318. Concerning one thing at least in the matter of hand-cars there is very little room for doubt, and that is that the old fashioned crank car is an antiquated and dangerous device. Its work in killing and maiming employés should condemn it both for the expense it causes in the item of damages, and for what should be a far stronger motive—safety to employés lives and limbs; and its use should be prohibited by statutory enactment. In the newer sections of the country, indeed, we are informed that pump cars are used almost exclusively. But many of the older roads are still using the old fashioned crank cars for no better reason than that they had better be worn out because they are on hand.

The car illustrated here is of course meritorious in respect to this matter of the driving action in common with other modern hand-cars, and its makers' claim many other points of superiority which we judge from inspection to be well founded. The wheel has an iron center, wood plates and felloes, and rim of wrought steel, this latter taking the place of the cast-iron tire which the makers have heretofore used. This composite wheel is not only lighter than the ordinary wrought spoke wheel, but has shown itself by several years use, to be much more durable. The materials used in construction are as follows: Frame work of selected ash, axles of H. P. steel, crank shaft of wrought-steel, walking beam of wrought-iron, brass boxes for axles and connecting rods, babbit boxes for crank shaft, gears of cast-iron. The car is thoroughly well made throughout, and while heavy and cumbersome details have been avoided, is strong enough to stand rough usage and hard work. The standard size has a 6 ft. platform, 20 in. wheel, 3 ft. wheel base, and weighs 425 lbs. For further information regarding it we would refer to the SHEFFIELD VELOCIPEDE CAR CO., Three Rivers, Mich.

The Sheffield Section Hand-Car.

House-Drains and Traps.*

Recent investigations seem to prove that certain elements of ordinary atmospheric air—chiefly oxygen—acting upon arobian microbes, destroy or attenuate their virulence, so that in either case the microbe, as a vehicle of specific disease, is annihilated. The significance of this fact, in relation to the proper ventilation of sewers and house-drains, has, I think, not been generally realized. The earlier advocates of such ventilation—among whom I venture to claim a place—aimed rather at the dilution and rapid removal of sewage emanations than at the destruction of associated microscopic organisms; but they were not without some apprehension of the truth, since demonstrated that such organisms are practically destroyed by the action of atmospheric oxygen. It is exactly thirty years since I myself published a paper on sewer ventilation, in which I endeavored to arouse the better class of my fellow-citizens by pointing out the fact that while they in the most elevated and least crowded parts of the city had to submit to the frequent recurrence of epidemic disease, the peopleon the banks of the river(which seemed to them so pestiferous) was almost exempt from anything of the kind. And my explanation was this. I said that "the agents at work in both localities were identical, but they were differently developed." In the one case tainted air, undiluted and confined for miles in unventilated sewers, remained pestilental, whereas in the other, "mingling freely with the atmosphere, it became harmless—as a homœopathic globule in a glass of water." I would be inclined to use very much the same language now—and I regret to say there is almost as much need to use it—but we have made an immense stride when we are able to plant our feet upon ascertained fact instead of reasonable but somewhat vague deduction.

We may indeed say that we have now new and potent argument in favour of drain ventilation. We advise it not merely for the dilution of noxious gases, and their rapid removal, or for the relief of hydrostatic pressure or the aeration of sewage, but also for the destruction of disease germs, or at least the attenuation of suspended virus: and it is evident that if we succeed in this we render our aerial drainage, if I may so call it, innocuous, so that even accidentally gained admission to our houses it would do no harm. To secure this, however, even partially, it is obvious that we must allow a much larger volume of fresh air to pass through our drains than has hitherto been customary—in short, the more nearly we can make them approach in airiness to the condition of open drains the better. These remarks apply to drains of every size, but in this short paper I shall refer to house drains only.

One reason why I do so is that it seems almost a hopeless task to convince those who have control of the common sewers that anything in the shape of ventilation is called for. After nearly forty years of sanitarian effort, argument, entreaty, and painful and costly experiences, it is now almost as necessary as ever thatthose who connect their drains with common sewers should carefully protect themselves against the risks they run in doing so. In this and many other things sanitarians have been very much like the "importunate widow," but after so many years' ineffectual reiteration of the same tale, they may almost be pardoned if they begin to despond. In the case of house-drains, however, they are able to appeal to individuals, and individuals are more amenable to reason. Now, our house-drains are under our own control, we can cut them off entirely from the common sewer and ventilate them as much as we like: and in view of the facts already referred to, this important question presents itself: Do we in practice ventilate our house drains sufficently to secure the best results? I think it is perfectly manifest that we do not, and that it is simply impossible to do so with drains of the size generally used.

Pipes of small diameter are recommended to facilitate rapid flow and scour; but we want rapid flow and scour of aerial as well as of liquid sewage, and we are met by this difficulty, that whereas small pipes are best for the one purpose, large pipes are absolutely necessary for the other. Now while we admit the importance of dealing with the aerial as well as the liquid contents of drains, we have hitherto made no adequate provision for doing so. We have, no doubt, several schemes of drain ventilation which are theoretically good, and which are useful so far as they go; but they stop a very long way short of that thorough flushing of the drains with fresh air which is desirable. In order to bring out clearly the difference between what is usually done and what I think ought to be done, let us suppose that we are dealing with a house of moderate size, having, say, two baths, three water closets, three basins, and three sinks; a 4-in. pipe would suffice to carry away the sewage from such a house, but in practice a 6 in. pipe would probably be used. Now in many—I fear I must still say in most—cases no attempt would be made to ventilate this drain at all, although soil-pipes connected with it would for the most part be ventilated. In some an outlet shaft would be provided, 9 ins. in diameter, in some 3 ins., and in a comparatively small number shafts 4 or 4½ ins. in diameter. Let us consider the state of matters in such a drain with the outlet shaft of the largest size. If we suppose that the contents of the drain would fill a 4-in. pipe, the 4½-in. shaft would give an area almost equal to that of the remaining empty segment of the 6-in. pipe, so that, roughly, what we have to do is to ventilate a tube, say 5 ins. in diameter and 100 ft. long, the greater part of which is horizontal. Even assuming that there are no restricting cowls or gratings at either end, it is manifest that in such a tube there could hardly be any appreciable current without the application of great mechanical force, even if we suppose the tube to be smooth and empty. But the tube we have to deal with is neither. It is rough, and it has for the greater part of its course an exposed surface, greater than that of a 5-in. tube, part of which is in motion in an opposite direction to that which the aerial current would naturally take. In such circumstances it is evident that the current would not only be sluggish, but variable, now in one direction, now in another, and often, when opposing forces were well balanced, stagnant. If such be the condition of a drain with a 5-in. air outlet, I needly hardly pause to consider the condition of the great majority now in use, which have nothing like so much ventilation.

Of course everything depends on what we call ventilation. If we mean by that term such a change of air in the pipes as is possible under the conditions just described, we may admit that some of our house-drains are ventilated; but if we mean by it constant flushing of our drains with fresh air having something like its normal proportion of oxygen, then I fear we must say that none of our house-drains are ventilated—with such restricted sectional area, and consequent friction the thing is impossible.

The question then comes to be: Can we provide the air space necessary for ventilation without either extending the exposed surface of the sewage or of the contaminated periphery with which the air must come in contact? I venture to think that it is quite possible, and indeed easy, to do so by means of a simple contrivance, which I now submit to you. A drain-pipe such as this may be of any ordinary size, but assuming that one having the upper portion 12 in. in diameter suffice, let us contrast it with the drain already described. In the first we had a sectional area for the transmission of air of (omitting fractions) 15 in.; in the other you have 120 in. In the first the surface of sewage exposed is 6 in., in the other 2¾ in., assuming that the maximum flow would fill a 4-in. pipe; so that in this new pipe there would be fully a half less exposed surface of sewage, and eight times the amount of air; besides which the flow of sewage would be more rapid, being more confined. In such a drain 100 ft. long, open and unobstructed at both ends, the current would not be overpowered by friction, and would hardly be affected by the comparatively trifling area of moving surface; and we by no means advise that it should be open at the two ends only, but at as many points as practicable along its course. Dealing with comparatively pure air we would be at liberty to make intermediate openings without risk—the fresh air would thus have the upper hand and keep it. We can give air as

* A paper by Mr JOHN HOBERMAN, F. R. I. B. A., read at the meeting of the Sanitary Institute.

was water too much to do, and in fact it is more dangerous to overcharge air than water with impurity.

But while I recommend the use of large pipes immediately in connection with the house, that is to say on the inlet side of the manhole and intercepting trap, I must observe that in most cases it will be advisable to use pipes of small diameter between the intercepting trap and the outfall, especially if that outfall be a common sewer. In that case our object must be to leave no room for air in the pipe—to use pipes large enough to hold the sewage and no more, so that when full, or nearly full, the air may be expelled from them. I speak of things as they are, not as they ought to be. Our sewers ought to be in a different condition, but while they remain a source of danger the more completely we shut them off from our dwellings the better, and the less we allow their polluted air to remain in contact with the seal of our intercepting trap the better. Where the outfall is good and the branch may be safely ventilated the large pipe of the section shown will be best. In short, the use of the one or the other is indicated by the practicability or otherwise of thorough ventilation

I must now make one or two remarks on the use of traps in connection with a thoroughly ventilated house-drain. The complete isolation of a house-drain is a fundamental condition. It must not be connected aerially either with a common drain or with the drain of any other house. Having secured that condition by means familiar to you all, and having also secured the thorough flushing of the drain with fresh air, it follows that trapping, as a protection against foul air, is unnecessary.

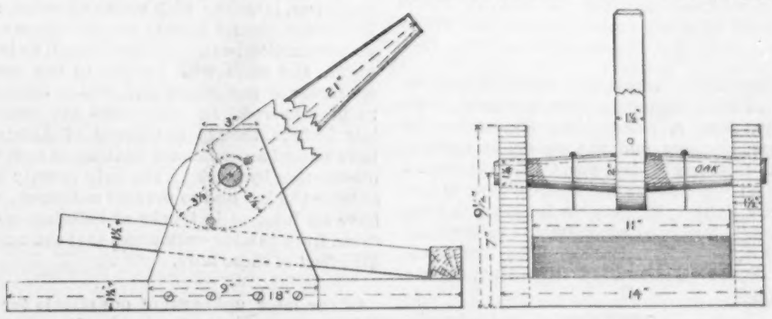
We are practically safe and the fewer traps we have either outside or inside the better. We do not require to trap soil-pipes, rain-water pipes, or gullies; and by leaving them trapless we only the better insure the purity of the air in the drain. The truth is that by a multiplicity of traps we create a multiplicity of obstructions and deposits, and to that extent interfere with the rapid cleansing and efficient ventilation of the drain. The only excuse for using traps inside at sinks, baths, and the like, is to protect the inmates from cold draughts. For this purpose some obstruction is no doubt necessary but it need not take the form of a syphon trap. If it does it is most desirable that every trap of the kind should be accessible and cleansable from the vessel with which it is connected. Scullery sinks should be provided with a grease box, which would also serve as a trap; but it ought to be inside, easily got at and regularly cleaned by the servant who works at the sink. By appliances at present in use it is impossible to catch the grease in close proximity to the sink, especially where much hot water is used, but I think the difficulty may be got over by a contrivance which I shall now describe. This consists of a shallow box encased with cold water, and covered with a movable grating resting about half an inch or more, according to circumstances, below the level to which the waste water will rise. The casing or jacket is really an expansion of the cold water supply to the sink, and the water in it would therefore be frequently replaced. The contents of the sink entering this box would at once spread over the cold bottom and impinge against the cold sides and raised central division. Much of the grease would rise through the grating and congeal above it, and thence be easily removed, but a good deal would no doubt adhere to the bottom and sides of the box. A depression is made at the end of the box to catch sand or other solids; the size would be in proportion to the amount of work to be done in the sink. It is evident that such a box would be quite easily cleaned, and that the cleaning of it could not be neglected without interfering with the use of the sink; moreover, as it would not be enclosed in any way, it would not be out of sight, and therefore out of mind.

I shall conclude with a word or two about the trapping of water-closets. The ordinary wash-out closets have necessarily traps which prevent the inconvenient or otherwise objectionable ingress of external air, but I have no doubt that a good valve closet without any trap is hygienically a greatly superior apparatus. The external air is effectually excluded in this case by the water held in the basin; but it would be sufficiently excluded by the valve itself if we assume that the air in the house-drain is innocuous. There is, therefore, no use of a trap in addition to the valve, and, without that obstruction, the contents of the closet are at once discharged into the drain and carried clear of the house in a few seconds. In this way you not only with certainty get quit of excrementitious matter, but also of water which has been in contact with it; whereas in trapped closets you may get rid of the former but not of the latter, and in many varieties you get rid of neither. It is about twelve years since I first ventured to use trapless closets, and I have recently had an opportunity of comparing some of these, which have been in use for more than ten years, with trapped closets of about the same age, with the following result: In no case was I able to detect the slightest smell from a trapless closet, however long I held the valve open, and in every case where the closet was trapped a most offensive smell was perceptible, if the valves were kept open for a few seconds. All my experience, indeed, points to this: That our best chance of safety lies in so contriving our house-drains and plumber-work that there shall not be one single receptacle where stagnation is possible throughout our entire system, and that the pure air of heaven shall constantly permeate every nook and cranny of it.

Besides plenty of air and a good scour, one thing more is desirable, if not essential, if the contents of our house-drains are to be harmless, and that is that they should be regularly cleaned. I may not enter upon this subject now, but venture to say that I see no difficulty whatever in having this cleaning done periodically at less expense, and with very much less trouble to the occupants of the house, than a somewhat analogous operation to which we are quite accustomed—the sweeping of chimneys. There is indeed no reason why we should not have drain-sweeps as well as chimney-sweeps.

A Home-made Copying Press.

The copying press here illustrated simply shows what can be done by an engineer who happens to be in the woods, and yet has use for certain of the "resources of civilization." The original press was made by Mr. J. F. O'ROURKE, the present Chief Engineer for the Union Bridge Co. at the Poughkeepsie bridge, and was devised by him to meet his wants when in the wilds of Wisconsin.



A Home-Made Copying Press.

It is so simple that anyone can make it, and is illustrated as a suggestion that may be useful to some others situated outside of the range of a trade press. It can be readily taken apart, and packed in a small space, and we can personally testify that it does its work in a most satisfactory manner In this case the frame and lever was made of a 1⅛ in. black walnut plank, but the shaft is of oak to better stand the strain upon it.

Wire-rope Haulage at the Grand-Ducal Mines at Klippberg in Teschen.*

During the past year large smelting works were laid out adjoining the station of Máriahuta-Zsakarocz, for the treatment of the iron ore from the Klippberg mines. A rack railway, 1 metre gauge, and about 2¾ miles in length, was at the same time constructed to the Susanna shaft, 765 ft. above the works; and for the further rise of 946 ft. to the Albrecht shaft a wire ropeway is now in working order. This line is 1,769 yds. in length, and has actual fall of 914.4 ft. from the upper loading stage. The gradient is not regular, but varies according to the surface: the steepest gradient being about 1 in 3. Several high roads are crossed, as well as a lateral valley of the Zsakarocz. The line is arranged with continuous rope, the corves descending with ore and ascending empty, or with timber or other stores. The bearing ropes are carried on piers, consisting of two upright and two raking posts with cross beam and pendent framing for the bearing sockets; the height of these piers varying from 6 ft. to 53 ft., and distance apart also ranging from small spans up to 558 ft. across the Zsakarocz valley. The up and down ropes are 6 ft. 6 in. apart. Proper arrangements are made for tightening the rope and adjusting for varying temperatures, certain lengths being fixed as maximum. The couplings consist of cast steel boxes with winding cone, right and left, in which the ends of each length of rope are screwed up and run in with composition, with two rivets to prevent twisting out.

The bearing rope is of sections: the down line (for the loaded corves) being 1.22 in. diameter, and the up line (for the light loads) 0.98 in. Dead load = 0.175 of breaking weight. At each end of the line a hinged tongue serves to switch the corves as required on to a siding, where they may stand in reserve or be loaded with other stores, without interrupting the passage of empty wagons; and so that on arrival at the head of the rack-railway the corves may pass either direct over the wagons on the latter or over the side shute.

The hauling rope is ¾ in. diameter, and consists of seventy-two steel wires, each 0.039 in. diameter. At each point of load it is strengthened about 10 per cent. to provide against friction or local strain. At the upper station this endless rope is passed half round one groove of a horizontal drum 6 ft. 6 in. diameter, then half round a second drum 6 ft. 3 in. diameter, and again half round a second groove of the first drum. The drums are set in motion by a horizontal shaft and crank worked by hand, but from the moment that the loaded wagon starts on the incline, no further motive power is required, as the force of gravitation on the steep inclined more than suffices to work the line, and the question of utilizing the surplus power remains to be settled later. Meanwhile a brakeman at the upper station controls the speed of the rope. Both stations are connected by telephone. The corves consist of cast-iron upper-framing, cast steel axles and grooved wheels, wagon body, and coupling apparatus. The framing, carried by the two wheels running on the bearing rope, hangs outwards, and is of triangular elevation. Upon the center of the base line is fixed the coupling apparatus. This comprises a clutch with grooved core, which is pressed by a vertical spring hard down on the traction rope. A horizontal spring presses against the head of the clutch, and keeps it from slipping. Above this is a hooked lever, with the short arm bent down over the end of the horizontal spring: and this hook, at a point just before the arrival at either station, is caught in an "unhooker," which raises the lever, pushes back the horizontal spring, releases the vertical clutch, and setting free the traction rope, automatically brings the corve to a standstill without hindering the travel of the rope. To refix the clutch on the rope, all that is necessary is to push back a button, which releases the horizontal spring, allows the lever-hook to fall back, and brings the vertical clutch spring again into action.

The staff required for working the line consists of a brakesman at the loading station, two men loading the wagons from the shute, one unloading at the lower station, and one at each end to switch the arriving wagons and couple on those which are loaded. The average speed is 4.92 ft. per second, and the corves are placed a distances of 131 yds. apart. The interval of time between the corves is, therefore, 80 seconds. This gives 45 per hour, of which, on an average, 40 contain ore, and 5 timber or other stores. The average load of ore being 1 cwt. the quantity capable of being transmitted per hour, is thus 10 tons.

* Wochenschrift des Oesterreichischen Ingenieur-und Architekten-Vereines. Abstracts of Papers; Institution of Civil Engineers.

IN the Colorado desert, near Idaho, there is a large bed of rock salt, and the Southern Pacific Railroad, in laying the track to the salt bed, has been obliged to grade the road for 1,200 ft. with blocks of these crystals. This is the only instance where the road-bed is laid and ballasted on salt. The sea, which once rolled over this place, dried up and left a vast bed of salt nearly fifty miles long. The supply is in exhaustible, and the quality excellent.—*Ex.*

A GATE worked by electricity has been invented in Baltimore designed to open at railroad crossings The advancing car puts in motion an electric motor, an arm is lowered at the crossing, and before the cars reach the crossing the gate is in position to prevent all passing. It remains in that position till the car has passed, when it is hoisted, as if by human hands, to its position in the air to admit of all necessary crossing.

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AT the regular meeting of the American Society of Civil Engineers to be held next Wednesday, Nov. 2, besides the transaction of regular business and the canvas of ballots. Mr. L. L. BUCK, M. Am. Soc. C. E., will read a paper on "Replacing the Stone Tower of the Niagara Railway Suspension Bridge with Iron Towers." Proposed amendments to the Constitution, signed by not less than five members, should be submitted in writing, at this meeting.

THE vote of the Master Car Builders' Association in favor of the Janney type of coupler, has done much to decrease the interest and importance of the action which may be taken by the special committee, which was formed to select a coupler, on behalf of 35 or 40,000 miles of road. Nevertheless that committee is charged with the duty of going a little farther than the Master Car Builders, in selecting a specific device for recommendation, and hence their final conclusions will be awaited with general interest.

The report, given in another column, of the late tests of the Janney indicate that it has so far been brought to the greatest perfection. In fact it would be strange if it had not, for certainly no coupler has ever been so thoroughly and carefully studied as the Janney, both experimentally and mechanically. It does not necessarily follow, however, but that the Dowling or some other coupler may be developed into what will ultimately prove the most efficient of all, or at least as efficient as any other.

The salient feature of the present situation is that the Janney is already about as near perfection as it is possible to make it, while the others are not.

We await with a good deal of curiosity as to what will be the general policy in selecting a standard coupler from the six or eight of the Janney type. The chances certainly seem to be in favor of the selection of the coupler which has given a name to the type; although it is not probable, nor do we know that it is desirable, that there will be anything like unanimity in this matter, and practice may fluctuate from year to year considerably.

IN the present lively investigation into the obstructions on New York streets and the best means of removing them, Commissioner COLEMAN notes one type of obstruction to his street-cleaners that is both curious and unexpected by the general public. That is, the storage upon our streets, at night, of about 6,000 trucks. What to do with these vehicles and where to put them, in our already crowded down-town districts, is a problem which the Commissioner confesses is too much for him in its solution. They can't be sent away every night and there is no available space to put them in, excepting the streets, and there they must be constantly shifted about in the street-cleaning process, and are an unmitigated nuisance to his department. Yet, what can he do about it? We give it up too, with the hint that if our authorities see fit to compel truck-owners to remove their vehicles from the streets during the night, probably the most economical scheme of storage would be to hang them up in front of the stores by means of a systematic arrangement of derricks and steam hoists.

The use of our streets for the storage of building material is a much more serious matter than that of the trucks. The latter, doubtless, interfere with street cleaning, and, if possible, should be removed; but the other is an obstruction in the daytime as well as in the night, and adds still further to the untidy character of our streets and makes more dirt to be removed. In both cases the common law forbids, though the Board of Aldermen have passed an ordinance winking at a certain obstruction by trucks. The only remedy is to enforce the law and to prevent aldermen, who have an interest in trucks or building operations, from passing ordinances that can nullify the effect of those laws.

Of the later upheaval of our streets for so-called subways—which are not subways at all; for the laying of electric conduits—which are only laid to be torn up again in the near future, and the steam-heating plant which is chronically tearing itself up, there is really little to say. Like the old man and his dumped load of apples, mere words fail to do the subject justice—it is too broad. The only lesson to be learned from the present condition of our streets is that we are a very patient people under long suffering. The Electric Commission, excepting only the mayor, seems to have but one idea in this matter of conduits, and that is to bury the wires somehow. Whether they will work efficiently when buried, work at all, or work only for a few months, seems to trouble them little, so that the wires are out of sight. They even cannot come to conclusions as to any one method, and the result is that they are putting down miles of various practically untried types of conduits.

The main purpose is a good one, but the trouble is that the law which compels the burying of the wires is unwisely framed and recklessly administered. It is for the present only, and does not recognize the fact that in less than ten years the growth of our underground street furniture will be so great that, if we keep it under the street at all, ample and much more permanent and expensive accommodations will be absolutely demanded, and the present outlay will be practically wasted. The solution of the problem presented is too deep in its technical features, and entirely too important in the waste of public money and public comfort involved for an average political commission. It is one that should enlist the best engineering and scientific skill that the city or country can afford, and after a careful study of the subject and the adoption of a definite plan of action, the city should appreciate the fact that the best article costs the most money, in engineering works as well as in the walks of ordinary commerce, and they should allow no false ideas of economy to interfere with the thorough carrying out of these plans. If it is not ready to spend the amount demanded by a satisfactory plan, it is worse than folly to throw away any part of this amount upon unsatisfactory and temporary expedients of very uncertain efficiency. As before mentioned, we are a very patient people and we could exist for a few years longer, even under the old conditions, if we were assured that when the remedy came, it would be radical and lasting.

THE almost phenomenal stops made by the Westinghouse experimental 50-car train at Chicago, St. Paul and other points in the West would seem to justify the public in hoping that the day of railroad wrecks from runaway and unmanageable freight trains is about at an end. When a train, over one-third of a mile in length, weighing 2,000,000 lbs. and moving at the rate of 40 miles per hour can be brought to rest within 500 ft., or when going at the rate of 22 miles per hour, in 184 ft., there certainly seems to be no excuse for accidents of the nature referred to. This air-brake on freight trains is a novelty, but has proved itself an exceedingly efficient one as a safety device and the law should make its use compulsory. Too many lives and too much property have already been sacrificed by the present cumbersome, unreliable and inefficient hand-brakes to permit their use after better devices are known and so thoroughly tested. Space forbids further comment just here, but the subject of these late trials will be discussed at further length in another issue.

WE have space to do little more than call attention to a very significant incident of the New England Road Masters' Convention. The resolution was presented, "that a tie should be 8 ft. long, 7-in. thick, at least 7 in. face, and sawn or hewed on two sides only."

It was at once moved to amend it by inserting the qualifying clause, "if they can be obtained in the market." Thus it appears that even in New England, the supply of available timber suitable for the ties which are required to carry our present rolling stock is becoming exhausted.

Those interested in the preservation of our American forests have long been sounding the note of alarm at the great destruction of young and growing timber which is caused by the enormous consumption of railroad ties. And as has been predicted, the timber suitable for the purpose is becoming scarce and dear. It is a query now what shall be done if we cannot get ties equal to the above specification. Our railway traffic has been vastly changed in the the last few years. Ties used to be taken out because they were rotten; now it is more often the case that they are cut into by the rail before they begin to suffer much decay, and if we have to accept narrow ties, this wear will be hastened still more. A broader rail base, bearing plates between rail and tie, preservative compounds which harden the wood as well as increase its life;—these are proposed remedies in whose merits and demerits all concerned in maintenance of way must take active interest. The subject of substitutes for the wooden tie, we have been apt to consider one in which American engineers have only a general interest and something whose practical bearing lay well in the future; but with the continued increase in traffic and weight of rolling stock, it cannot be denied that there is coming to be a demand for something which shall take the place of the present perishable rail support and make the term "permanent way" somewhat less of a misnomer.

It might be suggested to the elevated railway owners of this city, that the change on the Sixth Avenue line, from 1½ to 2½ minutes headway and four car-trains instead of five is the best kind of a bid for the inauguration of a rival system of rapid transit of some kind. It may be more economical to the corporation, but the crowding in the morning and evening hours is insufferable. The public wants more accommodation in the rapid transit way rather than a curtailment of what they once possessed; and if there is any doubt about it, let the doubter hang himself up by a strap for an hour's ride on a winter evening.

The Buffalo Crossing Question.

The first of what will undoubtedly prove hereafter a very large and a very important class of cases, has arisen in Buffalo and is now awaiting settlement. The rapid and simultaneous growth of a great city, and of great railroad yards on one and the same spot has at last brought about a condition of things which is felt to be already intolerable, and yet must inevitably grow worse. The city teaming traffic is interfered with to a very serious extent; the loss of time alone is very great, and the loss of hauling capacity, owing to the necessity of having loads readily manageable at these crossings, is also considerable, over 200 teams an hour passing over some of the crossings, with trains passing every minute or two. It is adduced that in frequent instances delays of twenty or thirty minutes are made necessary at crossings by the large amount of switching. The loss of life and limb is also large, and yet between 100 and 200 flagmen are already employed, and the number is increasing yearly.

In these conditions there is nothing peculiar to Buffalo, nor is there anything in them, there or elsewhere, for which either the railroad companies, or the citizens, are particularly blameworthy. Chicago, Indianapolis, and a dozen other cities have the same problem before them in (as yet) a somewhat less aggravated form, and the smaller places in which time is gradually creating the same difficulty are numbered by hundreds. It began quite naturally and properly while both the towns and roads were young, and goes on now from force of habit and as a vested right, although it is no longer either necessary or defensible, even pecuniarily.

For, common as circumstances have made the running together of streets and tracks on the same level in this country, it must be evident on reflection, to every intelligent person, or certainly to every engineer, that it is really a most unnatural arrangement, and not in any sense necessary or economical. Apart from the elements of danger and inconvenience, there is a direct money loss from such unnatural admixture far exceeding the cost of remedying it. But when, in addition to the deadening effect of habit alluded to in respect to such abuses, there has also been a gradual growth to a formidable aggregate of work which must be done at once to correct the evil ways, it is natural that the first tendency should be to temporize with the evil; to remedy its worst features, and to let those go which are simply *growing* worse until they also become so bad as to be no longer intolerable. Such a hand-to-mouth policy forbids all unity of plan, of course, and renders it highly likely that what is done to-day will have to be undone to-morrow at more than double cost, but it saves the need of looking the full extent of the evils in the face from the beginning, and of dealing with it as a whole from the beginning, and our weak human nature is naturally tempted by such a chance. It was so notably in Buffalo in the first agitation of this question, but recently there has been a wiser disposition shown, and there are strong grounds for hoping that the New York Railroad Commission, in whose hands the question now lies, will deal with it in a broad and thorough way, which will not only lead to an ultimate complete cure of the Buffalo evils, but will set a precedent for similarly fortunate action at many other cities.

If we look at the question abstractly for a moment we shall see at once that there can be only one permanent remedy. Both the street traffic and the rail traffic have in the past gone on growing simultaneously, and in the future are destined to continue to do so until each has reached a magnitude many times greater than now. It is indispensable for the public good that both should thus continue to grow without interference, and that neither should choke off the other. Yet if either be driven away from the ground which they occupy in common, they do choke off each other very seriously, and traffic by horses and by locomotives are so entirely antagonistic to each other that it is only when one or both of them is light that they can be intermingled without serious detriment. Therefore since the streets and tracks must be separated somehow, and cannot be effectually separated horizontally, there is but one change which will meet all the conditions, to separate the streets and the tracks from each other vertically, so that each can develop in any way and to any extent it pleases or may chance, without interference from the other.

This is what has been actually done in Europe on an enormous scale at an aggregate cost of hundreds of millions of dollars, and this, beyond question, is what would be done at once in this country if the railroad question were coming up now for the first time, and it were now first sought to enter with tracks our cities in their present stage of developement. To admit them on the level of the streets, as they now run, would not be thought of for a moment, nor would it even be asked, but it would be accepted as a matter of course that the tracks must run above or below the streets, to enter at all.

And as to whether the natural place for the tracks is above or below the street level there is room for as little doubt in all localities, like Buffalo, where the general surface of the city, where the railroad tracks occur, is almost a dead flat; and this is the case in the great majority of the cities and towns where this question is likely to become important hereafter. It is very much cheaper and very much better to elevate the tracks, and carry the streets under them, rather than carry the streets over the tracks, for these reasons:

First, the tracks are already elevated 2 to 4 ft. above the general surface, for drainage purposes, and generally ought to be raised more. To raise the tracks to 6 to 9 ft. above the general surface relieves them of trouble from snow and is otherwise highly beneficial, whereas, to sink the tracks is quite certain to do harm to the roadbed, even if it does not to the grades.

Secondly, the streets can, on the other hand, be lowered 4 to 6 ft. as well as not. There will still be a sewer underneath them to drain them as well as before, and moreover—a very important consideration—such a short quick descent to pass under a track, will not interfere with the hauling power of teams a hundredth part as much as it would to pass over the tracks by a bridge, first, because it is not nearly so high, and secondly and chiefly, because *the descent comes first*, and the succeeding ascent is passed with the advantage of a certain impetus gained on the descent.

Thirdly, the necessary difference of level for headway is much greater if a street is to go over the tracks than if the tracks go over the street. In the one case a clear headway of 16 to 18 ft. is necessary. In the other, a clear headway of 11 or 12 ft. will do very well, because that is sufficient to clear the ordinary heavily loaded team, and exceptional loads can always find some other point to pass by a slight detour.

On the other hand, if we attempt to carry street bridges over the tracks, since they must necessarily be quite high, say 18 to 20 ft. above the rails, or 20 to 22 ft. above the general level of the streets, we must necessarily have approaches which are both long *and* steep. Steep bridge approaches in cities like Cincinnati or Montreal, where a large proportion of the streets are on a steep grade to begin with, might not be so great an evil; but in flat cities like Buffalo, or most other American railroad towns, where the streets are otherwise almost on a level, to introduce such steep and long bridge approaches throughout the city, means a very serious and entirely inadmissible diminution of the hauling capacity of every team in the city. Again, such approaches must necessarily be long, cannot of necessity be the full width of the street, and are a nuisance to adjoining property and will surely depreciate its value.

To sum up; the railroad tracks do not admit of being lowered, but are greatly benefited by being raised. The streets will not admit of being raised without grave injury, but can be readily lowered considerably. To raise the tracks above the street, requires only two-thirds as great difference of level, and enables the changes to be divided between streets and tracks. To raise the streets above the tracks, not only require a much greater total change of level, but requires it all to be in the street and greatly injures the adjoining property.

The question resolves itself into one between raising the tracks 5 or 6 ft., and raising a whole city, or a large part of it, 15 or 20 ft., and in such case the answer cannot be doubtful. The only plan worthy of serious consideration, therefore, is that of raising the tracks.

This becomes clearer if we consider, apart from all detail, the natural and proper cost of so carrying the streets and tracks on a separate grade. No doubt "it is easier to keep up than to catch up." We cannot go on for a generation doing things wrongly and back-handedly, without laying up for ourselves a considerable amount of extra expense and trouble which will come all at once, when the buildings which we have built and the work which we have done wrongly has to be at last made right. But after all, that is a temporary and minor evil. The permanent question is: What is the natural and proper cost of keeping the tracks above and out of the way of the streets, so as to allow each to be mutiplied indefinitely without interference with each other?

When we come to consider the matter in this way, it is astonishing how little foundation we find for impressions which are almost universal among Americans, that such complete separation is a pretty costly business. To raise an acre of ground 1 ft. requires 1,614 cu. yds. of earth, which at the fair price of 20 cts. for such work amounts to only $323 per acre per vertical foot of lift, or $1,600 per acre for a 5 ft. lift. There is or soon will be within the city limits of Buffalo some 600 miles of track, by far the largest amount to be found within the limits of any city in the world, or on any equal area. If we allow these tracks to be on an average 14 ft. between centers, instead of the usual 13 ft., they will occupy almost exactly 1,000 acres, and it will cost the

enormous sum of $323 × 1,000 × 5 = $1,615,000 *to raise every track in the city limits of Buffalo five feet higher*, or say 7 to 9 ft. above the general surface in all. We allow nothing for the expense of putting this dirt under the tracks, and some like incidentals, because they would be more than covered by the general benefit to the track from such a lift, half of which is badly needed for maintenance alone.

But it is obvious that no such amount of lifting could in the nature of things be required. A large mileage is already lifted and carried above the streets. A larger mileage yet is along the water front or other edges of the city where there are no streets to be carried under, nor likely to be. A larger mileage yet is concentrated in enormous yards which it is not likely to be at all important to carry streets across for half a generation, if ever.

The bare raising of tracks then is, in its essence, a trifling matter. The same is true of the bare dropping of the street. The paving and sewerage cost no more. All that may be required extra is a small retaining wall for the side-walks. As for the crossing proper, an ordinary bridge crossing to carry two tracks over a street, with solid masonry abutments and, perhaps, 80 ft. span in all, of iron girders, will cost little, if any, more than $6,000. If then, we allow that there are some 300 street grade crossings in Buffalo which do now, or soon will, require separation (and there are already about that number) we reach these appalling totals as the cost of disposing of all of them:

For 300 overhead bridges at $6,000	$1,800,000
For raising 60 miles of track, as above	1,615,000
For retaining walls and other extra work on streets, say (liberally) $4,000 per crossing	1,200,000
Total	$4,615,000

This amounts to the enormous sum of $15,383 per crossing, and it will suffice, and yet it has just been estimated, and no doubt with truth, (by Mr. THOS. W. SPENCER, Inspector of the State Railroad Commission, who has recently prepared a report on the matter) that it will cost about $400,000 to take out the three worst crossings of the city only, including the collateral work of raising stations and building retaining walls, but, on the other hand, it is to be remembered that these three crossings average over twelve tracks each, so that they are equivalent to over eighteen such crossings as were estimated for above.

Now, to protect a grade crossing properly, takes two flagmen, a day and a night man, the least probable wages to whom are $1,000 per year, a sum which, at 5 per cent., represents the interest on $20,000. It will be seen, therefore, that *the saving in flagmen alone* is enough to warrant eliminating grade crossings, although that is only one of several advantages, even to the railroad companies. To the city, it not only greatly reduces the cost of teaming and the danger of accident, but by ridding the streets of the tracks would unquestionably add enough to the assessed valuation of Buffalo (and many other cities) to make it a paying operation for the city also to bear the whole expense of doing so, if it were reasonable or just that it should do so.

Making all allowances for possible errors and omissions in calculations which we have not sought, nor wished, to make exact, it is apparent that a city of 230,000 people and over $130,000,000 valuation, both rapidly increasing, is entitled to demand that its streets be freed from tracks, and should demand it with almost equal insistence whether it pays all or none of the cost of doing so itself. The vast railroad interests which center in that city, likewise, should not only not oppose such a measure, but should welcome it, for vast as their traffic now is, it is but a fraction of what it will be, and they will be but laying up greater trouble for themselves in the future by hand-to-mouth methods which avail for the moment only, and take no account of the permanent necessities of the situation.

What has been done so far in the Buffalo matter is a long way off from what should be done, as is but natural. The demand of the citizens for relief was vague and indefinite. The response of the officer detailed by the Railroad Commission, Inspector SPENCER above mentioned, was a careful report which made some very wise and detailed recommendations as respects the most important crossings, but which utterly failed to take a broad view of the problem as a whole, and hence recommended under-crossings here and over-crossings there, in a way which would have relieved the most urgent immediate necessities indeed, but which would, if carried out in full, have been worse than doing nothing at all, since it would have tied up the streets and the tracks so that nothing more could have been done anywhere in the vicinity to meet the crop of new necessities which is as sure to be as urgent a few years hence as these are now. Last week a hearing was had in Buffalo before the Railroad Commission at which the railroad companies were to submit "a plan," and they did submit one if it can be called such, signed by the chief engineers of the four leading lines, of which all the engineers who proposed it ought to be ashamed, and we have no doubt some of them are, for it would be difficult to treat a great and serious problem, deeply concerning a large population, in a less adequate way, or with an air of more cynical and contemptuous indifference. What the report really meant, however, we have no doubt, is simply that the railroad companies have not yet begun to consider the matter seriously, and do not intend to do so until they have to. In the end, we have no doubt, the railroad companies will be easily persuaded to do what is just and reasonable, but they very naturally decline to take the initiative in formulating demands upon themselves. The matter now rests for the present with the Railroad Commission, whose findings and recommendations we shall await with much interest, and pending its appearance forbear further summary. It is not likely that their first report will end the matter. If it simply makes a good beginning of an end, it will be all that can be reasonably expected.

Our Drainage.

It is somewhat of a satire upon "modern civilization" that in our multitude of devices for adding to the comfort and convenience of man we should really be exposing our fellow beings to ills of which our ancestors knew little. Yet such is the case, however, and an article on "House Drains and Traps," elsewhere given in this issue, makes our meaning plain.

Loud is the outcry from the press when a railroad accident maims or kills a score of passengers. But of the many thousands of deaths annually occurring from vicious plumbing practice, in the houses of the rich as well as the poor, and the constant violation of the laws of sanitation, the same public press has comparatively little to say. Technical publications seem to preach in vain and the proof of this is seen in the statistics of every health board of our large cities. And stranger still is the fact that it is not in the cheap buildings and squalid homes of the lower classes that this mortality is alone to be observed; but this same neglect and its consequent death penalty is only too often noted in houses where every other luxury that wealth and refinement can suggest is present—everything but immunity from disease.

The present system of crowding many families under one roof in the prevalent "flat" has doubtless much to do with the danger from diseases of the typhoid class. Each family must have its conveniences, distinct from other families, and the danger from this source is consequently magnified manifold. Every modern improvement is promised in such cases, and in the best class of these buildings is doubtless originally provided, according to the light of the architect and builder. But like every other machine these conveniences need attention, and constant vigilance in their supervision is the price of even ordinary health; their neglect too often means death.

Leaving out of the question for the present the vicious or grossly ignorant work of the jerry builder and its consequences among the thousands of the poor who are its daily victims, a word of caution is in order to those who are surrounded by all the comforts of life and trustfully believe themselves to be safe from all harm on the score of typhoid diseases. To these we would again say—be very watchful of your surroundings. Your sanitary appliances may have been once all that the highest art and widest knowledge of the modern "sanitary plumber" could provide; in fact, they may have once been absolutely safe. But they will not last indefinitely and are not always automatic in their working, or constantly self-cleaning and self-purified. Household refuse, grease, an old dish-cloth, may check their working and turn what was otherwise a very useful arrangement into a channel of disease. And there is no high pressure alarm, no electric bell or other kindred appliance to sound a warning note; the danger may be even unaccompanied by noisome smells that would appeal to one of the senses. But a subtle, insidious something pervades the air we breathe, until too often it is only in the pallid cheeks or feverish brow of some one that we love that the fact is made apparent that "something is wrong with the drainage."

The evil to which we refer is wide spread and exists in spite of stringent laws intended to control both original construction and later maintenance; the market swarms with patented devices to neutralize the results of bad work or carelessness on the part of the householder, and the problem is so vast in its proportions and ramifications that it is extremely difficult of solution. But to a certain extent every man can look out for his own premises and report to the proper authorities any apparent violation of law by his neighbor. Personal carelessness in such matters and the trusting to luck and to the inspection of "some other man" is at the bottom of a great part of our troubles. If the penalty were an empty house, your landlord would very probably fix things up; but as long as you suffer in silence you will just as probably continue to do so until—disease wins the battle and empties the house for yourself as well as the landlord.

Outside of the house the general condition of our drainage is nearly as bad, and in some cases worse; and there the power of the individual must be massed to have any real effect. In our own city the old drainage system is now being overhauled and it is being done none too soon. Already bad work, long covered up, has been brought to light; and though the inspection has hardly commenced in earnest, places have been found where the old sewer has been crushed through by the load of rock-filling thrown upon its crown, and for years the sewage has simply been saturating the soil under stores and dwellings, instead of passing to an outlet as was confidently supposed. For such dangerous practice the only remedy is to first find it out by careful and intelligent examination, and then to speedily and thoroughly reconstruct the works on a permanent and effi-

cient basis. It may take years to purify the reeking soil, but in any event the further contamination of the ground we live upon, and the air we breathe should be checked.

We are entirely too careless of results, and too patient under existing conditions, in this matter of drainage, inside of our houses and out of them. And this is said with due respect for the engineers who planned our systems and those who extend and maintain them. Our cities have outgrown the wildest dreams of their projectors, even of a generation or two ago. And it is no light task for the modern engineer to adjust the past conditions to present demands. But to shirk either condition or demand, and attempt a makeshift, is to only postpone the evil day, and to leave for another generation the inheritance of a still more colossal task—or, perhaps, an epidemic.

The bright spot in this otherwise rather dismal picture is, that honest effort is being constantly made to improve upon past conditions. Our latest practice in sewer building, as a rule, is as perfect as the most careful study of well trained engineers can make it, and the constructive detail is usually excellent. And so also in our houses, the better class of work and more scientific design prevails wherever it is paid for, and more stringent laws are being enacted to make this payment compulsory whether the builder desires it or not. It is in the old sewerage systems and in the house drainage put in before proper sanitary laws were formulated that the greatest evils exist. Though, as before mentioned, carelessness in the maintenance of even the more modern and best house fittings will bring with it a direful penalty; their only excellence lies in the facts that they are better designed to start with, and less liable to get out of order than the older types. But they will bear close watching all the same.

Guard Rails and Bridge Guards.

The recent discussions of these subjects by the Road-Masters' Conventions at Cleveland and Hartford, should be of great interest to all who are concerned with the department of maintenance of way, and, indeed, to every railroad officer who has any interest in securing by a "stitch in time" that safety which in the case of railway safeguards is more apt to save ninety or nine hundred than the proverbial nine.

While the guard rail at frogs is not exactly a safety appliance, in that its use is essential, or is generally considered essential, to the operation of the switch, the question of its proper form is one of so much importance and the use of improperly laid guard rails has caused so many accidents, that the reduction of practice to a correct standard is really an important step in the direction of safety. It is surprising that this appliance, which is as old as the railroad itself, should still be used in about every diverse form imaginable. Probably one reason is that it has been considered of no particular importance. Any old piece of rail of almost any length and bent in almost any shape has been spiked down for a guard rail; and though now-a-days, on all first class roads at least, very much more attention is paid to them than formerly, they are still long or short, straight or curved, spiked or braced or bolted, according to the various theories of the road-masters under whose supervision they are placed. Both the Associations have voted on standard forms, but the standards are at variance, the National having a 5-ft. tangent opposite the frog point, while the other is curved for the whole length; and in fastenings and minor points the two standards are also different.

A very important idea in this connection was that brought out by several members of the New England Convention and referred to in our report of the Hartford meeting. This is the practice of laying the rails tangent for about 2 ft. in front of and behind the frog and keeping the opposite rail up to gauge. It was the experience of several that with a frog laid in this manner, the trucks would be steadied before reaching the frog, and nothing but a wheel out of gauge would ever grind against either the frog point or the guard rail. This is a matter which is very often not understood or is neglected in laying frogs, but should always be attended to in the interest of safety and economy. With frogs laid in this manner and kept in true line and surface there will be very little wear of the guard rails. This does not do away, however, with the need of a secure fastening for a guard rail, for defective trucks on loaded freight cars are apt to give it occasional severe wrenches. The surest and most ingenious fastening we have yet seen to hold guard rails from tipping is that in use on the Maine Central, in which the ball is cut off from the ends of the guard rail and they are bent around at right angles and slipped beneath the main rail.

A matter which has received much less attention than its importance deserves, is the subject of guard rails for facing split switches on the main track. On a double track their use can and always should be avoided, but on single track roads they are necessary. An automatic split switch well made and laid is a pretty safe appliance, but it is none too safe. In the case of a train facing the switch, any derailed wheel will throw the switch and split the train. Guard rails are sometimes used like those opposite frogs, simply to prevent loose wheels or wheels out of gauge from striking the points. They should curve inward and meet at the center of the track so that a derailed wheel will be deflected and will run between the main rail and the point. Accidents at split switches which are probably due to this cause are by no means rare and are apt to be very serious, and the Convention certainly did a wise thing in taking action in reference to the matter. This, indeed, would be a proper subject for legislation; but as the cost of the proposed safety appliance, by using worn rail, which is just as good for the place, may be made very trifling; and its benefits are so obvious, there should be no need of making its use compulsory.

The interest which the members of both Associations manifested in the subject of bridge guards, and the action which they reported their companies were taking in the matter, gives very gratifying assurance that the terrible disasters at White River Junction and Forest Hill have not been in vain. Of the standards adopted, that of the New England Association, is superior by reason of its specifications concerning the bridge floor, to which the other Convention made no reference. The latter body, however, in adopting the LATIMER-CHILDS device, illustrated in our issue of Feb. 12, of the current year, were in advance of the New England Association. It is certainly true that a bridge floor should be strong enough to carry a derailed wheel, but it is equally true that the rerailing frogs should be used, and also that the inside guard rails should be set up close to the main rail, leaving not more than 2 or 3 in. of flange way so that a wheel once on the bridge will be guarded from derailment. If the rerailing devices are not used; it is better to set the guard rail about 8 in. from the main rail, leaving room for a derailed wheel to run on the ties between them, the guard rail serving only to keep it in line. But this arrangement does not, like the other, guard a wheel from derailment while on the bridge. And it certainly seems a matter of much importance to keep trains on the track while crossing a bridge, as well as to care for wheels derailed just before reaching it, and with two inside guard rails set to leave only proper flange way, derailment is as nearly impossible as it can in any way be made.

In conversation with a member of the New England Association, he stated as an objection to the re-railing device, that a very frequent cause of derailed trucks is broken wheels, which, if replaced on the track, are pretty sure to leave it again. But with the close guard-rail described above, the sound wheel on the other end of the axle would almost invariably keep the broken wheel on the track if it was replaced there by a rerailing frog. As was shown in our issue of May 21, the existing patent on an absurd addition to the LATIMER rerailing device, has no reference to and in no way covers the device itself. The essential features of the invention are free for any one to use, so that the expense of the re-railing blocks is reduced to the cost of the castings at the railroad company's shops. We shall not, therefore, be accused of "puffing," when we repeat, that a bridge guard which is without rerailing blocks loses its most important and most valuable feature. No man is justified in neglecting its use longer, as some great accident ere long will again illustrate.

We are not of those who believe that railroad corporations are bound to adopt every scheme and device that promises any increase of comfort or safety without regard to expense. The great public does not do that for itself, and corporations certainly have an equal right to "count the cost." But in the case of the safety appliances described above, which pay for themselves in the long run in the saving of damage to property and life, or in the case of steam heating from the locomotive, which is actually more economical than the old fashioned stove, it admits of no doubt whatever that the corporation which neglects their use is not only practising a short-sighted economy that will prove extravagance, but is exercising a criminal neglect in failing to secure that reasonable safety to the lives of its passengers and employés which it is its moral and legal duty to provide.

American Progress in China.

The recent rumors of interference with the Barker-Chinese concessions have brought out a direct and emphatic denial from Mr. WHARTON BARKER that there was anything approaching a repudiation of contract by China. The names of some of the Philadelphia backers of the syndicate are also now published and show that there is plenty of money and influence back of the scheme, Among these gentlemen are—SAML. L. SHIPLEY, President of the Provident Life and Trust Co., HAMILTON DISSTON, JOSEPH WHARTON, GEO. PHILDER, JOHN WANAMAKER and HENRY C. GIBSON, all gentlemen of very great wealth and commercial position. In all, twenty capitalists are said to have subscribed $50,000 each to the $20,000,000 nominal capital of the Oriental-American Co., and the other half is to be held by the Chinese capitalists. A Finance Company with a capital of $5,000,000 is to be formed under the laws of Pennsylvania to conduct the preliminaries of the organization of the Chinese-American Bank, with its valuable privileges of coinage, railroad and telegraph and telephone contracts, etc.

We note among the Philadelphia capitalists interested men whose names are a synonym of commercial and financial shrewdness and

business success; and as they represent many millions of money collectively, gathered together by the exercise of the same talent that ought to make such an enterprise go, the outlook for ultimate success is excellent.

But, as mentioned in our last issue, these gentlemen must expect and be prepared to vigorously combat a most lively and organized attempt to interfere with the aims of the syndicate from the representatives of rival commercial powers. The virtual control of Chinese progress and civilization, from a western standpoint, is too rich a prize to be allowed to slip away to our shores without a determined struggle on the part of those who wish to control it themselves. And the battle ground will be China, and not Philadelphia.

Then, too, the Chinese ship of state has had her anchors down so long in the mud of conservatism and old-time ideas that it will be a tremendous task to shift her moorings. There are so many interests to consult, and so many prejudices to combat in China itself, that foreign interference may prove the lightest stumbling-block in the way of the realization of the purposes and hopes of the American syndicate. We heartily approve of the scheme, and do not hesitate to say that American ideas are the best for Chinese interests in such a revolution, as being most typical of the new life which the more enlightened of the Chinese rulers wish to inaugurate. But we would also warn the too sanguine that as Rome was not built in a day, so progress in China will probably be much slower than they anticipate.

The American syndicate goes into this affair to make money out of it, and not from any sentimental interest in China's welfare alone. And as the leaders in this project are business men with great resources, they doubtless appreciate the fact that dividends will have to be patiently waited for. But to the young American engineers, and those of other professions, who look upon this as a brilliant and immediate opening, we advise some cooling of enthusiasm and a certain slowness of going. Much machinery will have to be set in motion in China before they are wanted, and this machinery is so rusty and out of line that an enormous amount of oil, time and patience must be expended before everything goes smoothly and the way is opened to the American adventurer. England, Germany and France will undoubtedly assist a powerful home party in China in clogging these wheels and retarding our interests; and this Continental and English intrigue must be met by "diplomatic" measures of a similar import and a like degree of unscrupulous but keen and well trained pushing of national and individual interests. In this fight our Philadelphia capitalists can expect little assistance from the accredited representatives of our Government, as the politicians usually sent to such places are, under our system of foreign service, no match for the sharpness of foreign agents, who are especially fitted by careful and long training for the positions they fill. The American-Chinese syndicate must select its own agents and upon the ability of these agents will really depend the ultimate success of the whole enterprise. It will be an interesting fight, and the best man will win. Let us hope that the shrewd Yankee has not lost his old-time prestige.

The New Chicago Lake Tunnel.

As indicated in our advertising columns, the city of Chicago is inviting proposals for the new lake tunnel lately authorized after much discussion.

The new tunnel will be 8 ft. in diameter, and extend from a point in Lake Park, in an easterly direction, out four miles under the bed of Lake Michigan. Two permanent shafts only are contemplated, one in the park and the other at the extreme eastern, or lake end; but such other working shafts may be sunk as the engineer may direct.

The Lake Park shaft will be as near the edge of the lake as practicable, and will be 10 ft. in diameter, with its invert 80 ft. below city datum. The manner of sinking is left optional with the contractor, but the shaft must ultimately be lined with brick masonry not less than 16 ins. thick, with the brick laid in four rings with maximum joints of one-half inch. At the bottom of the shaft will be a 5 ft. sump and shore and lake outlets 8 ft. 2 ins. in diameter.

The tunnel will rise 1 ft. per mile, and be 8 ft. wide and 8 ft. 2 ins. high in the clear. The bottom and top arches will be semi-circles, and the brick masonry is to be 13 ins. thick in three rings of shells. The bricks will be laid horizontally with the edges towards the center, and set in hydraulic cement mortar with no joint between the courses exceeding ⅛ in. and between the rings not less than ¼ in. The ground to be tunnelled is believed to be a firm clay with pockets of sand or gravel and occasional boulders. But the contractor must take the work at his own risk and no extra allowances will be made for quicksand, hard-pan, or boulders. The excavation must conform to the outside line of tunnel, and any space outside must be solidly packed with masonry at the contractor's expense if this extra excavation is chargeable to himself or his men. The contractor must furnish all lumber for bracing and put this in place, and also all pumps, ventilating plant, etc., and carry away the excavated material to any designated point not more than one mile from a shaft.

The lake inlet differs from that on the other tunnels in not having a protecting crib but in commencing flush with the bed of the lake, at that point about 42 ft. below the surface of the water. In its construction, a temporary timber crib will be used, containing a well-hole 25 ft. across. Through this well is to be sunk a cast-iron cylinder 10 ft. inside diameter, with metal 2¼ ins. thick, and the 6 ft. sections connected by inside flanges 5⅛ ins. wide by 2¼ in. thick, with 1⅛ in. turned bolts spaced 7 ins. c. to c. When the bottom of this shaft shall have reached its final depth and have been properly connected with a low brick vertical shaft rising from the tunnel, the portion above the bottom of the temporary crib is to be removed, and a bell-mouth casting, about 9 ft. high and 13 ft. in extreme diameter, will be bolted on to the inlet cylinder with the rim of this bell just flush with the bed of the lake. Around and under the bell will be a collar of concrete about 25 ft. in extreme diameter and 6 ft. in maximum depth. And after the temporary timber crib is removed, the surface of the lake bed, for a diameter of 75 ft., will be paved with a 3 ft. bed of concrete. The adjustment of the bell-mouth and placing of the concrete, as well as danger from flooding the tunnel will require that the well in the temporary crib be air and water-tight, as compressed air may be used in this stage of the work.

The intermediate shafts would be made of iron cylinders, 10 ft. in diameter, and on practically the same plan as that described for the inlet shaft, excepting that the lower part of the iron cylinder must be filled with concrete when the shaft is no longer required.

The Commissioner of Public Works reserves the right to stop the tunnel at 2½ miles from shore, and in this case will demand that the whole work be completed within 42 months after signing the contract. If the tunnel is to extend 4 miles out, the last 1½ miles must be pushed at a rate of not less than 1,800 lin. ft. of completed tunnel in one year for each working face. In letting, the work will be divided into three sections, viz.: the land tunnel and shaft; the 2½ miles east of shore shaft, and the remaining 1½ miles.

OTTAWA, ONT., despatches say that English capitalists have made a proposition to the Dominion Government to build the 8 mile submarine tunnel under Northumberland Strait, dividing Prince Edward's island from the main land. Among the parties making this offer is Mr. GREATHEAD, the Engineer of the Thames subway, now being constructed. These gentlemen propose to take and operate the Prince Edward's Island R. R., on a tariff approved by the Government, and the scheme includes "a subsidy of $200,000 per year for 50 years." If built this tunnel would save 672 miles of water travel and 24 hours time in the passage from Montreal to Liverpool.

Committee Tests of the Janney and Dowling Couplers.

The Committee on the selection of Uniform Draw Bars held a service test at the New Durham and Weehawken yards of the West Shore Railroad on Friday of last week, which, though not largely attended outside of the committee, was highly interesting in the points developed.

Only the Dowling and Janney couplers appeared; the former being on five standard 60,000 lbs, P. R. R. cars, and the latter on five "Fast Freight Line" cars, (60,000) of the same company, equipped with air-brakes and train whistles. These cars were built in the latter part of 1886 and had been in service nearly a year. The Dowling had been applied specially for the trial.

The Janney was taken in hand first, and the usual tests of coupling and uncoupling with one, and with both heads open, successfully made. Also coupling at the rate of eight miles or so an hour, to determine whether the action of the locking device was quick enough to secure coupling before the cars should recoil. These were also successful. The tests were made on a straight track, and an easy reverse curve.

The Dowling performed all the operations of coupling and uncoupling mentioned above successfully, and coupled with the Janney with either head open. When testing for coupling at the rate of six or eight miles an hour, the pin on the Dowling coupler at the rear end of the first car from the engine was bent, and would not drop.

The engine with the first car essayed to couple several times, but was not successful, and when starting with the car for another attempt, the hook broke at the bend. The fracture showed a fine quality of steel, but the casting will have to be made much heavier to meet the requirements of service.

The yardmaster of the West Shore had expressed a desire that the couplers be tried on a curve in the Weehawken yard where they at times were unable to couple a link and pin. The curve mentioned is 23°. The train was taken on it with a Dowling and Janney alternating. The trial was made of uncoupling a Dowling and a Janney. This was successfully made by opening the Janney head when on the inside or outside, but could not be accomplished by opening the Dowling on either side. The next test was coupling a Dowling and Janney, this was tried several times with first a Dowling head open, then a Janney, and finally with both open, but was unsuccessful. The cars were then assorted, and those with the Dowling tested for coupling and uncoupling on the curve. Trials were made with the head on the inside of the curve open, with the head on the outside open, and with both open, but were unsuccessful, the projection on the hook preventing their engaging.

The cars with the Janney were then taken in hand, the five being separated about 10 ft., and placed around the entire curve. The engine dropped down, picking up one after another, without the slightest difficulty on the first attempt. This was done with the head on the inside of the curve open, with the outside head open, and with both open, the Janney both coupling and uncoupling at any point.

The tests on curve were the best and most thorough that have been made for some time, and deserved a larger attendance. The results are certainly significant, although often a very slight change will correct serious defects in the working of new mechanical devices under exceptional conditions.

The Effect of the Reservoir System of the Upper Mississippi River.

Since 1880, when Congress authorized the construction of the reservoir system in the upper Mississippi for the assistance of navigation, the following reservoirs have been created:—Lake Winibigoshish, capacity, 40,000,000,000 cu. ft.; Leech Lake reservoir, 22,000,000,000 cu. ft.; Pokegama Falls reservoir, 23,000,000,000 cu. ft.; and Pine River reservoir, with a capacity of 7,000,000,000 cu. ft. By 1885 the three first named were completed and their storage drawn upon for 70 days, with the effect of increasing the channel depth of the Mississippi, at St. Paul, 1½ ft.

In 1886, the river being at a very low stage, the storage was drawn upon for 170 days, with about the same increase as in 1885 in the St. Paul channel. This was done in face of the fact that the reservoirs

were not intended, or expected, to furnish water for more than 90 days in each year. In other words, the system has been a success, and now the largest river steamers unload at St. Paul at all seasons without trouble.

The gates of the reservoir dams are never entirely closed, unless for repairs. The ordinarily low volume of water in the basins tributary to them, is allowed to flow at all times, only the surplus water being collected. The gates are shut down in the fall, in order to collect the water from the fall and spring rains, and are not raised until June or July, when the water in the river at St. Paul begins to get very low. The gates of the lower dams are opened first, and when the water in these reservoirs is exhausted the gates of the upper dams are raised, and the supply in those reservoirs is drawn upon. It takes about two weeks for the water in the upper reservoir to reach the main channel of the Mississippi; and it takes about two weeks longer for the water to reach St. Paul in any considerable volume, although the effects are felt a few days earlier. This year—1887—has been one of drouth in parts of Minnesota and Wisconsin, and the waters collected in some of the reservoirs was less than in 1885 or 1886. Nevertheless, since the first, they have steadily furnished a large proportion of the volume of water passing Minneapolis and St. Paul. In 1885 the reservoirs added 30 per cent. to the fall at St. Paul for 30 days; in 1886, from 24 to 45 per cent. for 170 days; this year, 33 per cent. during August and September. At Minneapolis, the percentages were greater—Sept. 30 reaching 40 per cent. The Pine River reservoir seems to be unequaled in the amount of water furnished in 1886 and 1887. The system is not by any means complete, but four reservoirs having as yet been created.

The indirect advantages to the great lumber and flour mills at Minneapolis, have also been very great. In July and August, of this year, nearly all the water available for power came from the reservoirs; and, whereas, in previous years they depended upon steam alone in these months, nearly half their power now came from water. As coal costs $7.50 per ton the saving is evident. And the lumbermen instead of building dams of their own and wasting water for the millers, now find the flow from the reservoirs sufficient for their purposes in the summer months. The magnitude of these two interests served can be estimated from the fact that last year the flour output was valued at $37,000,000, and the lumber at $6,000,000.

PERSONAL.

Mr. HOWARD MURPHY, Sec. of the Engineers' Club, of Philadelphia, will make the surveys for the proposed water supply at Bristol, Tenn.

Mr. SETH BEMIS, one of the earliest directors of the Boston & Worcester and Fitchburg railroad companies, died recently at Boston, Mass., at the age of 75.

THE headquarters of the engineer corps of the Montreal & Smith's Falls Air Line, Canadian Pacific Ry., has been established at Smith's Falls, Ont.

Mr. G. WINMILL, Manager of the Indian State Railway system, is visiting this country for the purpose of examining the construction and operation of American railroads.

Gen. G. T. BEAUREGARD was in the city lately, and was tendered the freedom of the rooms of the American Society of Civil Engineers.

Baron Lieut. SERDOBIN, of the Engineer Staff of the Russian Army, is now visiting the United States, and will report to his Government on the condition of railroads and the public works of this country.

Baron RUDOLF von GUNESCH, a prominent engineer of Austria, after a long trip across the continent, has just returned to New York. He expresses himself highly pleased with the trip.

Mr. GEO. D. BROOKE, late Master Mechanic of the Chicago & Atlantic R. R. at Huntington, Ind., has accepted a similar position on the Texas & Pacific R. R., with headquarters at Marshall, Tex.

Mr. EMIL KUICHLING M. Am. Soc. C. E., of Rochester N. Y., recently resigned as a member of the Executive Board, of that city. Mr. KUICHLING will have charge of the surveys and plans for the proposed east intercepting sewer to be built in the City of Rochester.

Mr. EUGENE F. FALCONNET, M. Am. Soc. C. E., ate President of Aetna Iron Co. of Nashville, Tenn., died Oct. 14. He became a member of the American Society of Civil Engineers June 3, 1874, and at that time was Chief Engineer of the Cumberland & Ohio R. R., Louisville, Ky.

Mr. HENRY F. RUDLOFF, M. Am. Soc. C.E., formerly Government Engineer of Venezuela, and Chief Engineer Caracas & Antimano Railway, is now in this city engaged in making extensive maps, plans, drawings, etc., for the improvement of the harbor of Puerto Cabello, railway stations, custom house, public stores and other buildings for the improvement of Venezuela.

Mr. WM. NORRIS, late Chief Engineer of the Chicago, Kansas City & Texas Ry., and Principal Assistant Engineer of the Kansas City, Independence & Park Ry., has recently opened an office in Kansas City, Mo., for the purpose of carrying on the railway supply business, under the firm name of WM. NORRIS & Co.

Mr. NORRIS has for a number of years been identified with railroads throughout the west, as a civil engineer, and the name of NORRIS will, no doubt, be familiar to many railroad men, his grandfather being one of the pioneer locomotive builders in this country, having built locomotives in Philadelphia early in the year 1831.

FREDERICK W. VAUGHAN, Mem. Am. Soc. C.E., and late President of the Louisville Bridge & Iron Co., died at Louisville, Ky., on Oct. 19. Mr. VAUGHAN was born in Warren, Me., on June 6, 1844; graduated from Rensselaer Institute in 1863, and was elected a Member of the Am. Soc. C. E. in 1869. During the Civil War he was Assistant Engineer on Government railways; and later was Principal Assistant Engineer to Mr. FINK in the building of the Louisville bridge, and at the time of his death he was president of the bridge company above named, and Chief Engineer of the Henderson Bridge Co., and Consulting Engineer to the Louisville & Nashville Railroad.

Facts Concerning High Explosives.

Broadly speaking, dynamite is an explosive of maximum power with minimum risk; it will, as a rule, explode only by the agency of a detonating fuse; ordinary rough handling, concussion fuses, flames or sparks are ineffective to explode it. The sequel of its safety lies in the fact that the absorbent is soft, compressible and elastic, whereby the powder becomes a cushion on which all the blows are delivered. A blow upon it is like a blow upon a meal bag. Hence the greater the quantity the greater the safety. A pound of dynamite suspended from a fishing rod by a string 6 ft. long can be exploded without injury to the holder of the rod and without even scratching the end of the rod or destroying more than one-half of the string.

Explosive gelatine is more difficult to explode than dynamite, requiring 3.5 times the force. The addition of 2 or 3 per cent. of camphor makes it still safer, so that the impact of a bullet will not explode it. If slowly heated, dynamite explodes at 356 deg. F., explosive gelatine at 379 deg. F., or when very quickly heated at 414 deg. F. The gelatine is entirely indifferent to moisture; even when submerged in water for several months it does not lose anything of its effectiveness.

The experiments made by ARDEER show that the power developed by the explosion of a ton of dynamite is equal to 45,675 foot tons, or tons raised 1 ft. One ton of nitro-glycerine similarly exploded will exert a power of 64,352 foot tons, and 1 ton of blasting gelatine 74,050 foot tons. The power exerted is in inverse ratio to the cube of the distance from the point of explosion; in other words, if the power at 1 ft. from the explosion be represented by 1,000,000, at the distance of 150 ft. it will be but 1. Blasting gelatine consists of nitro-glycerine combined with a certain proportion of nitrated cotton. Representing the power of dynamite as 1,000, that of nitro-glycerine is 1,416, and that of blasting gelatine 1,555. —*Army and Navy Journal.*

THE Hagerman tunnel, recently completed on the Colorado Midland R. R., is claimed to be the highest tunnel in the world. It pierces the Saguache Range 11,530 ft. above sea-level, and is 2164 ft. long and 16 ft. wide by 18 ft. high. The cost is published at $2,000,000. But as the Alpine tunnel on the Union Pacific R. R. is put down at 11,694 ft. above sea-level, the claim of the Hagerman is not sustained by 94 ft.

NEWS comes from Lima that the Grace-Aranibar contract, in the interest of Peruvian bondholders, is rejected by the Government owing to involved complications with Chili.

Rope and its Use.

The *Bautechnische Zeitung* gives some very good suggestions concerning the selection and use of rope. We condense as follows:—

A good hemp rope is hard, but pliant, yellowish or greenish gray in color and has a certain pearl-like lustre in its fibres. When dark in color it is an indication that fermentation has set in during curing, and brown spots show that the fibres were spun when damp and these spots are consequently soft and weak. Rope should be dissected to see that it has not been made of good fibre outside and poorer material within. Short fibre, strands of unequal length and uneven spinning should also be looked out for. In the first case the projecting ends give the rope a woolly appearance; the other points can be learned by inspection only.

The use of a core, or central strand, somewhat increases the strength of a rope; but as this core is shut in it, is liable to rot and affect the rest. For this reason any rope that smells musty or mouldy should be rejected. Russia, Switzerland, Alsace and North Italy furnish the best hemp, and the strongest fibre is said to be obtained from plantations at the foot of high mountains.

Ropes for use on shipboard, or when they are liable to be often wet, are usually soaked in tar to preserve them. But the effect of tar is injurious though its action is not clearly defined. This effect is said to be lessened by repeatedly melting the tar and washing with water before application. The water however, in this case, is worse than the tar, in its ultimate effect.

According to experiment, the tensile strength of a wet rope is only about one-third that of the same rope when dry; and a rope saturated with grease or soap is weaker still, as the lubricant permits the fibres to slip with greater facility. Hemp rope contracts strongly on being wet, and a dry rope 25 ft. long will shorten to 24 ft. on being wet.

Engineering and Railway News from Abroad.

(Specially Prepared for ENGINEERING NEWS.)

Organ f. d. Fortschrittle des Eisenbahnwesens.—The engineer of the combined adhesion and rack railroad between Blankenburg and Tanne gives a detailed account of the modifications made in the locomotives. The engine now is a three-coupled tnak locomotive with outside frames on the Hall system. The three axles are in front of the fire box, and many changes have been made in the parts and their arrangement by Herr ABT. The two cog-wheel axles are placed in a special pair of frames, and by this device the wheels are not affected by the oscillations of the locomotive and the cog-wheels enter always to the same depth, which is a great advantage over the Riggenbach. The three spur disks which are placed against one another and form the wheel are not placed on the cog-wheel axle but connected by eight strong bolts with the brake wheels to the right and left, which latter are on the axle. A special series of instructions for the engine drivers has been issued, most of which refer to the use of the air brakes. The Harz railroad has also proved very satisfactory and no changes have been found in the roadbed. The Abt system has now been introduced into Venezuela, Afghanistan, Bosnia and the Rhone Valley. The speed both for mountain and plain is now to be increased to 6.2 miles per hour. Another article on a similar road in Baden refers to changes in the racks.

Archiv f. Eisenbahnwesen.—This periodical is published by the Prussian Ministry of Public Works and contains articles on the measures taken by the Government for the welfare of the State railroad employés and on secondary railroads in Austria.

Zeitschrift f. Strassenbau.—Herr DENHARDT gives the results of wood and other pavement in Frankfort. The first wooden pavement was laid down three years ago. It was of beech and fir. It has been partially renewed and is now again uneven and spongy. Other experiments even in streets where there was little traffic were equally unsatisfactory. The results with sheet asphalte have been far better. In a lecture by Herr LANGE, on American street making, etc., we are informed that we cannot have good roads until labor is cheaper. Switzerland

will soon have quite a number of secondary roads. One Zurich contractor lately obtained concessions for three cable lines—at Graz, Salzburg and Innsbruck. At the lake of the Four Cantons will be three cable roads. In fact every first-class beer saloon perched on a mountain will soon have its own cable. Mount Pilatus, to the ascent of which that of the Rigi is nothing, is now to be made accessible to bad climbers. The maximum grade of the Rigi is 25 per cent., that of Pilatus is 48; the minimum radius of the former is 180 metres, that of the latter 80 metres; the length of Rigi is 1363 metres, Pilatus will be 16,361. There will be two cog wheels which will enter horizontally each side. The system is different from any other and several precautionary devices are used. "Streets as they should be," from a veterinary's point of view was an address delivered to the German S. P. C. A. Some streets abroad are too rounded and polished off. Good macadamized, or granite paved are still the best, for horses at least.

Schweizerische Bauzeitung.—An article by Prof. TETMAJER treats of the volume constancy of hydraulic cements. The action of air and water are considered, and various formulas given. Air especially attacks sharply burnt cements, which imbibe a great deal of carbonic acid. The best Portland brands which had withstood the action of water for several years, became soft on exposure to the air. It was found from many experiments that the decay of cements exposed to the air was owing, not to the chemical composition but to defective preparation of the raw material, to its want of homogeneity and mixing. The decay in water is caused by an excess of matters which undergo an increase in volume by oxidation and imbibing of water. Among these matters are the sulphides—especially the sulphide of lime which is transformed into a basic sulphate of lime ($Ca_2\ SO_5 + 7\ H_2\ O$). Even 1 per cent. of the sulphide has an injurious effect in Portland cements. In the case of rough grain or bad handling there is a skin of ferrate of lime surrounding a knot of caustic lime that becomes gradually slackened and increases in volume. But even with good grain, and mixing, etc., damage is done from excess of swelling stuffs, such as lime, magnesia etc.

There is also an illustrated article on the Castle of Chillon, so celebrated and sung by BYRON.

Eisen Zeitung.—The increase in the iron production of Germany since January 1st has been 10 per cent. The exports of raw iron has been less than last year. Still the imports of raw iron during the first seven months were 80,657 tons; rails 4,370, and rod iron 10,079. The exports on the other hand were: 134,838, 98,906 and 115,817 tons respectively. The total production of raw iron for this year is estimated at 3,800,000 tons. Germany is thus exceeded only by England and this country.

Centralblatt der Bauverwaltung.—"On the Art of Building Arches," by Architect RHEINHARD, treats the subject practically. More attention is being paid to masonry. Rough surfaces of stone work form the best union with Portland cement. A very full table of calculations is given in an article "On Calculating the Material for the Iron Superstructure of Straight Street Bridges." There are several interesting articles of an architectural character.

Wochenschrift des Oest Ing. Vereins.—A very interesting lecture on the "Canalization of Large Cities" was given before the meeting of Austrian engineers by Herr KINDERMANN. The smaller cities such as Danzig, Cologne, Frankfort, etc. have now very fine water systems. The southern German cities show a very provident system of dealing with the sewage, which is collected in tubs and sold to the neigboring farmers. In fact a "Tonnen-Verein" has been formed. In Stuttgart such matter is collected in cemented pits which are regularly emptied. A clear gain of 60,000 florins was made last year. In Augsburg a "poudrette" factory has been established, and is in successful operation. In China, what the Spanish call *buen retiros*, are provided along the highways by the farmers and travelers are requested to use them in the agricultural interest. An extended article is the "Sea Bank Defences in Holland," by Von HORN. The mouths of the large rivers require constant care. The old system of "sink pieces" is too costly and ineffective owing to the great depths at the mouths of the rivers, and a new system by C. de BRUYN has been suggested for the Oudeland sea dam. The sink pieces would be used, but only for the protection of single projecting strips of the dam, while the currents are directed against these protected spots, as the currents will not go far landwards between two projecting strips of dike. The system is economical, but has given rise to much discussion among engineers in Holland, and when partially tried at Terneuzen did not give satisfactory results.

ITEMS.

Several important improvements are to be made in the port of Lisbon, the contract for a portion of them has been already adjudged to Mr. HERSENT, the Panama canal contractor.

Syra (Greece) is to have water, gas and sewers all at once, while a tramway line is also in view.

A company for the manufacture of railroad rolling stock is to be formed in Buenos Ayres.

No fewer than six plans for railway lines in Chaco (Arg. Rep.) are now put forward.

A new port is to be formed at San Nicholas, on the Parana, Arg. Rep.

The Frankfort Chamber of Commerce have petitioned for the construction of a navigable canal between Antwerp and the Rhine. The saving in a distance of 327 kilometres would be 137 metres.

Railroad building is going on in Venezuela, but means of transport are very limited, even between large cities.

The new Mexican lines will extend 8,000 miles, and as there are no navigable rivers, railroads are a double necessity. Many cities would like waterworks, but are prevented by economic reasons, among them Vera Cruz, Oaxaca, Guadalajara. At Guanajuato 65 kilometres of pipes have been put down. A Belgian firm is likely to have the Oaxaca contract. Contractors fight shy of the Vera Cruz water-works. A great proportion of the work would have to be done under the railroad embankment.

The School of Civil Engineers at Tokio, Japan, is very liberally endowed by the Government, but many pupils have been lately sent to France and England to complete their studies.

SOCIETY PROCEEDINGS.

Engineers' Club of Kansas City.—A regular meeting of this club was held at the Deardorff Building, Oct. 3, 1887. J. A. L. WADDELL, Vice-President, presiding. Upon a canvass of ballots E. W. STERN, CHAS. H TALMAGE, and CHAS. W. HASTINGS were elected members. The paper of the evening on "The Construction and Operation of the 9th St. Cable Railway" prepared by Mr. M. K BOWER, was read by Mr. C. G. WADE. Mr. P. W. KEERSTED was proposed for membership by Messrs. G. W. PEARSONS and J. A. L. WADDELL. Mr. KEERSTED was invited, and consented to read a paper at the next meeting—subject to be announced. T. F. WYNNE, *Sec'y pro tem.*

Department of Mechanic Arts and Engineering, Arkansas Industrial University.—This institution located at Fayetteville, Ark., announces under date of Oct. 20, that a Society under the above name has been organized with its first meeting to be held at Little Rock, Ark., on Nov. 10. A list of about 20 very interesting papers is given, which are to be submitted to the Society, and includes the names of some very well known engineers. For any further particulars address, Prof. J. M. WHITHAM, Fayetteville, Arkansas.

New England Road-Masters' Association.

WEDNESDAY, OCTOBER 19; EVENING.

According to a custom of the Association, the first part of the evening's session was given up to the representatives of the firms who had their goods on exhibition, and the members listened to the statements they had to offer concerning the merits of their devices.

In nut locks the iron clad fibre washer, made by the Vulcanized Fibre Co., of Wilmington, Del.; the National lock washer, made at Newark. N. J.; and the Excelsior double and single nut lock, made by Ruffner, Dunn & Co., of Schuylkill Falls, Philadelphia, were exhibited and described. The Metzler Railway Lantern Co., of Philadelphia, showed their reversible lantern, which shows either a red or white light, and may be changed instantly from one to the other. H. CHANCE, of Fostoria, O., showed his solid steel frog and verified his claim for its durability by very commendatory testimonials from those who had used it. He also showed a model of a newly invented crossing which dispenses with frogs entirely and leaves either track blocked when the other is clear. The Sheffield Velocipede Car Co., of Three Rivers, Mich., had a very complete and interesting exhibit of their goods, including velocipedes, section hand cars, and the Dodge stand-pipe. A model was shown of an expansion joint, the invention of a New Hampshire Road-Master, for use at the foot of grades and in any place where track gives trouble from creeping. The well known Bush interlocking bolts were shown by models and photographs; models of a reversible flanger and a combined guard rail and foot guard were on exhibition; and representatives were present from the Ramapo Iron Works and the Jersey City Iron Works.

A notable exhibit of a different sort from the above, was a venerable railroad tie which had been in service for 36 years, and to all appearances was still hale and hearty and good for another generation. The tie was sent by A. C. BEAN, of the Central Vermont, and we understand was birch timber Burnettized.

It was nearly 9 o'clock when the meeting was called to order, and the discussion began upon the first of the stated topics: "How to Secure Economy of Labor and Material in Maintenance of Way." On the work to be done at different seasons of the year, the general practice seemed to correspond closely with that advocated in Parsons' "Track," the force being varied largely at different seasons of the year, according to the availability of laborers and pressure of work. There was some difference of opinion, however, as to the ability of most foremen to work large gangs with economy. The northern members seemed to be under some disadvantages compared with the three southern States. They required a larger force to keep the track clear in winter, and while they acknowledged the bad practice of putting in new ties before the frost was out of the ground, stated that they were obliged to do it or they would not finish the renewal of ties till well into the summer.

There was much difference in opinion and practice concerning the proper length of sections. One member had once had charge of a section 11 miles long with mud ballast. It was quite generally thought that the prevailing practice of 4½ to 6 miles in length, was in the long run very expensive. One member remarked that he wanted to know how to get about twice as much work done with no more expense, and looked to short sections for help. In long sections the time lost by the men in going to and from their work, is a disadvantage, while in short sections there is not enough work in winter to keep busy the force necessary to keep on hand for replacing a broken rail. The subject was still under discussion when the meeting adjourned.

THURSDAY, OCTOBER 20.

In the morning the members assembled at the yards of the New York, New Haven & Hartford Railroad and witnessed the working of an automatic semaphore signal; of a three throw point switch made by the Jersey City Iron Works; and of Smith's portable rail saw, a machine which is attached directly to the rail and showed itself able to saw through a 70 lb. steel rail in about 14 minutes. A most effective little tool was also shown for pulling spikes among frogs and switch rails, that could not be reached with a crow bar. It was made by the Verona Tool Works of Pittsburg and its extreme simplicity, cheapness, and excellence in saving labor and profanity were highly commended by the members.

On returning to the hall the discussion of the preceding evening was resumed, and after some debate it was voted to be the opinion of the Association that the section length for double track should not exceed 3 miles, and for single track 4½ miles. It was then voted that the amount of help required to keep a track in good condition was not less than one man per mile for single track and two per mile for double track, taking the average of the whole year.

The next subject discussed was the proper form of guard rail for frogs and switches. The chairman of the committee to which the matter had been referred reported the following resolution: "*Resolved*: That the best form of guard rail is from 12 to 15 ft. in length; curved the whole length with a radius of 150 to 175 ft. with the center 6 in. ahead of the point of frog; securely spiked, and kept from tipping by three braces, one opposite the point of frog and one on either side."

The discussion which ensued showed that there was considerable variation in practice among the members. One used a 21 ft. guard rail with 5 in. opening at the ends. Another varied the length of his guard rails according to the length of the frog. Some were in favor of guarding the whole length of the frog while others advocated guarding only the point and claimed that it was bad practice to draw the wheels against the frog wings. The most important division which developed was on the general theory of the guard rail. Several members stated it as their belief, that with a properly laid frog and a set of trucks in good condition, a wheel would never strike the guard rail at all. This result was attained by compounding the curve at the end and leaving a short tangent each side of the frog and also keeping the main rail strictly to gauge. The proper office of the guard rail these members contended, was to "guard" the occasional sprung axles, wheels out of gauge, etc., which would not run true and guide them on the right side of the frog point. A number of other members were of the opinion that a guard rail was apt

to get hit oftoner than would be the case if this were true. They experienced much trouble in keeping their guard rails from turning over. Braces didn't hold them down. President STEVENS showed a form of guard rail that had given great satisfaction in his practice in which the ends were bent around at right angles and spiked. Thus the spikes on the inside of the guard rail had to start before the rail could turn. Mr. NEVENS of the Maine Central had tried the same device, but the guard rail would come up. He then cut off the ball of the rail and bent the foot at right angles in the opposite direction, shoving it *underneath* the main rail. Thus the guard rail could not rise unless the ends twisted off. He had secured his guard rails in this manner for some years and they had given perfect satisfaction The report of the committee was finally adopted by the Association by a majority vote.

The next question for discussion was the important one of guard rails on bridges and bridge floors. The committee on this matter made an extended report, citing three accidents that had come under their notice, in two of which the absence of any guard rail caused serious wrecks, and a third on the Frankenstein trestle, Portland & Ogdensburg Railroad, where a guard rail had guided a derailed truck safely across, although before reaching the guard rail the wheels had run a foot and a half away from the main rail. The report then recommended, "a strong bridge floor and guard rail for all bridges, arranged as follows: Cross ties, 10 ft. long, 8 × 8 in. and 8 in. or *less* apart, secured in place by a timber 6 × 7 in., gained on to each tie near the outer end and bolted firmly. Guard rails to be placed inside of track rails and 8 in. from them, approaching the center of the track at about 30 ft. from the ends of the bridge, and connected by an old point of a frog." The discussion which followed the committee's report showed that about all the companies were interesting themselves in the matter of guard rails, and that most of the bridges were now protected to some extent. One point on which opinion was divided was the matter of extending the outer guard rail some distance beyond the inner, and curving it out from the main rail, so that a derailed truck would be brought in to where the inner guard rails would guide it back into line. It was generally thought, however, that if a derailed truck once got far enough away from the rails so that it would strike on the wrong side of the inner guard rails it was too far out to be brought back into line again, and had better go down the bank before it reached the bridge. A few members believed that in rare instances a derailed truck might be farther out than half the gauge and still be saved, and one instance was cited. Variations in practice were given, and an amendment was offered to make the distance apart of the ties 4 in., but it was lost by a close vote. An amendment was adopted, however, that the long ties be used for a distance of 30 ft. from the bridge and that an outside iron guard rail should extend out from the end of the guard timber on these ties, curving away at the end from the main rail. The report of the committee, with this amendment, was unanimously adopted.

The Convention next took up the subject of foot guards at frogs, switches and guard rails. This was of especial interest to some of the members as the laws of Massachusetts now require their use on roads in that State. The committee's report favored a piece of plank fitted into the space as the best device with which they were acquainted. One member had used a cast-iron filling piece which gave satisfaction except after a sleet storm in winter when the ice would accumulate on them, and wheels passing over would break them. Another member stated that the Hart foot guard was adopted on his road, and while it was not a perfect foot guard, it was the best device he had ever seen. This resolution was finally adopted: "that a plank fitted between the rails is as safe a foot guard as any with which we have had experience."

The subject of road tools was next taken up and the matter of hand cars was discussed. Most of the roads were still using the crank cars, but they were generally condemned as dangerous. It was stated that a crank car would outrun a pump car on a down grade, while the reverse was the case on an up grade. It was thought that pump cars should be made to throw in and out of gear so that the men would not have to work them on down grades. It was also thought that the gallows frame was too low for men of average height. The report of the committee on road tools was finally adopted by a unanimous vote, the report being as follows. "We have no special recommendations to make except in the matter of hand cars. In our opinion the Sheffield wood wheel, steel tired, pump car has no superior."

The subject of nut locks was then discussed, and several members gave their experience with different devices. The following resolution was finally adopted by a majority vote: "*Resolved*; that while the Pratt washer, Vulcanized Fibre and National nut lock are each of them good devices, the Excelsior, double or single, made by Buffner, Dunn & Co., is to be recommended for excellence and economy."

On the subject of railroad ties the resolution that a tie should be 9 ft. long, 7 in. thick and at least 7 in. face was lost by a close vote, and a resolution was carried unanimously that when it is possible to obtain them, ties for main track should be 8 ft. long, 7 in. thick, at least 7 in. face, and sawn or hewed on two sides only. A year ago the Association passed a resolution recommending the split switch for use in preference to any other form and the discussion of switches turned principally on the advisability of using guard rails to split switches where trains run facing the points, to obviate the accident which occasionally occurs of a derailed wheel turning the switch and splitting the train. After some discussion and narration of experience, which seemed to fully affirm the wisdom of the resolution adopting the split switch as standard, the following resolution was passed: "*Resolved*, that a guard rail should be used on all main track split switches where trains run against the points."

At 6 P. M. the technical work was brought to a close and after prayer by the Chaplain the final adjournment was taken. The next morning several of the members accepted the courtesy of the New York, New Haven & Hartford officers, and under the escort of President J. S. LANE took an excursion to New York City.

LATEST CHANGES OF ADDRESS, AMERICAN SOCIETY OF CIVIL ENGINEERS.

ALEXANDER G. BRINCKERHOFF, care JOHNSON & MORRIS, 114 Leonard St. New York City.

HENRY W. BRINCKERHOFF, 84 Fulton St. New York City.

HENRY J. GIELOW, 113 Hudson St. Jersey City, N. J.

BENJAMIN D. GREENE, New York Hotel, New York City.

W. D. JENKINS, Engr. in charge Chicago, Milwaukee & St. Paul Ry., Room 4, Hall Building, Kansas City, Mo.

ELLIS B. NOYES, Asst. Engr. in charge New York State Canals, Syracuse, N. Y.

JULIUS H. STRIEDINGER, care Am. Soc. C. E., 127 East 23d St., New York City.

GEORGE E. THACKRAY, Asst. Supt. Steel Dept. Springfield Iron Co., Springfield, Ill.

N. O. GOLDSMITH, Engr. The Weir Frog Co., 20 Ortiz Building, Cincinnati, Ohio.

ARTHUR POU, Cons. Engr. S. D. & W. S. L. Ry., and Chf. Eng. Ala. Midland Ry., Talbotton, Ga.

CLINTON B. SEARS, Captain Corps of Engineers, U. S. A. St. Paul, Minn.

HERBERT A. TOUNG, Revere, Mass.

Subscriptions to the Building Fund are to date, as follows:

Subscriptions previously reported	$8,619.5
Frank L. Griswold	100.0
	$8,719.50

NOTE. Amount reported last week should have read: J. Imbrie Miller $134.50

CONSTRUCTION NEWS.

Water.

Bismarck, Dak.—The new water-works, which are being built by contractor Danaher, are approaching completion. The trenching and pipe laying are progressing and the reservoirs are nearly completed. Only one of the reservoirs will be roofed and used this winter. The trench for the suction pipe, which will extend 100 ft. from the pump house into the river, is being dug. There will be 41 hydrants on the distribution system. Col. MONROE is in charge of the work.

Marblehead, Mass.—Mr. FRANK L. FULLER, C. E., of Boston, Mass., writes us as follows, under date of Oct. 25:—"Will you kindly correct the impression made by an item in your last issue (p. 302), in which the statement was made that the Marblehead water-works had proved to be 'inefficient.' The system, which is not yet complete, was designed to supply the summer residents on the 'Neck' and along the shore between it and Swampscott. It also connects with about a mile of 10-in. pipe laid in the center of the town some years ago for fire protection. The supply is temporarily taken from the Marblehead Water Co., a private company having its works located at Swampscott, an adjoining town.

"At present all the water used in Marblehead must pass through about 1,200 ft. of 6-in. pipe, and a considerable length of 8-in. pipe, located in Swampscott, before it reaches the Marblehead line, so that although the pipes in Marblehead are of ample size, it was not to be expected that four engines (the number employed at the test) would make a good showing, drawing water from the Swampscott stand-pipe, nearly 4 miles away. A 10-in. pipe in addition to the 6-in. pipe mentioned above, is to be laid at once in Swampscott, which will greatly increase the efficiency of the Marblehead system. At a town meeting held in Marblehead, Oct. 18, it was voted to make the necessary investigations to determine the expense of completing the system begun this season. With a large stand-pipe, at a higher elevation than that in Swampscott, located within its own limits and near the center of the town, there will be ample fire protection. These facts will correct a false impression made by your item."

New Water-Works.—*Maine*—Fairfield. The water-works are nearly completed; there will be 5 miles of mains.—Old Orchard. The water-works are nearly completed.

Massachusetts.—Beverly. The new water-works, which cost about $140,000, have been accepted. M. PICKETT is Superintendent.—Monson. A local water company is to be chartered. R. M. REYNOLDS is interested.—Winchendon. Proposals are invited for a system of water-works: the supply to be from Naumkeag lake or from artesian or driven wells. Address THE WATER-WORKS COMMITTEE.

Rhode Island.—Block Island. Water-works are contemplated and it is proposed to have them in operation by next summer. The supply will be drawn from Fresh pond or Sands pond.

Connecticut.—Canaan. The water company is laying larger mains in consequence of the increased consumption.

New York.—Albany. Work is progressing on the driven wells and Engineer DE VARONA expects to let contracts for work on the gravity system in November.—Herkimer. The Water Commissioners have had two wells sunk to ascertain the quality and quantity of water to be obtained for the proposed water-works.—Syracuse. The Syracuse & Salmon River Water Co. will apply to the Common Council for a franchise. WM. A SWEET is interested.

New Jersey.—Passaic City. The city is agitating the question of a water supply from the upper Passaic river.

Kentucky.—Georgetown. A water company is to be organized. Address JOHN A. BELL.

Tennessee.—Chatranooga. The 20-in. pipe to connect the new stand-pipe with the city mains is being laid; work is also progressing on the filters and stand-pipe. It is expected that the works will be completed by January.—Bristol. A water supply system is projected and surveys will be made by Mr. HOWARD MURPHY, Philadelphia.—Athens. The Athens Mining & Manufacturing Co. has awarded the contract for water-works to a Nashville company.

Georgia.—Fort Valley. Water-works are contemplated. Address S. B. BURR.—Dalton. Water-works will be established.

North Carolina.—Hendersonville. The new water-works will cost about $12,000. Address JAMES D. DAVIS.

South Carolina.—Sumter. Work will soon be started on the new water-works.—Columbia. Jeter & Boardman, of Brunswick, are negotiating for the water-works.

Florida.—Green Cove Springs. Water-works are contemplated. Address J. S. WRIGHT for particulars.

Missouri.—Columbia. A system of water-works is contemplated.

Kansas.—Wichita. The water supply is obtained from the Arkansas river; there are 75 driven wells on an island in the river and from these the water is pumped.

Michigan.—Cedar Falls. Water-works are to be established. Address the City Clerk.—Lowell. The supply for the new works, which are being built by Grand Rapids parties, will be drawn from 20 tube wells, averaging about 23 ft. deep.

Illinois.—Trenton. It is proposed to establish water-works at an early date.—Carlyle. The new works have not yet been accepted by the city.—Clinton. The well that was to have supplied the town with water has given out.

Iowa.—Missouri Valley. It is proposed to issue bonds for $25,000 for a system of water-works. The question will be voted upon in November.

Nebraska.—Norfolk. The Norfolk Water-Works Co. has been incorporated by A. C. CLARK, GEO. TURNER, J. S. MCCONNELL, and others, with a capital stock of $200,000.—York. The York Water-Works Co. has been incorporated by A. C. CLARK, GEO. TURNER, S. K. FELLON, and others, with a capital stock of $300,000.

California.—Bedding. A new water company is surveying for a supply from Spring creek, 6 miles north of the city.—Nipomo. The water-works are completed; 5-in. mains are laid in the town.

Texas.—Kyle. The Kyle Water Co. has been incorporated. C. L. SLEDGE is Secretary.—Waco. The City Council has ordered an election for Nov. 4, on the question of issuing bonds for a new system of water-works. The council employed R. F. HARTFORD, hydraulic engineer, of Memphis, Tenn., to investigate and report upon the works and plant of the Waco Water-Works Co. and, according to the Galveston *News*, his report was decidedly unfavorable.

Canada.—Saint Sauveur, P. Q. The Municipal Council has decided to put in water-works and invites plans and estimates to be submitted before Dec. 1.

Kansas City, Mo.—The new water supply, which was turned on Oct. 18, was inaugurated with considerable ceremony. The first water-works were built in 1874-75, and began operations in 1877 with about 300 consumers, 15 miles of pipes and a consumption of less than 500,000

galls. daily. The growth was slow till 1878, when there were 20¼ miles of pipe, with 753 consumers, using about 1,000,000 galls. a day. From that time the consumption has steadily increased.

The following table shows the growth of the work:

	Miles of pipe.	Number of hydrants.	Millions of gallons.	Number of taps.
1878	20¼	224	318	750
1879	24	250	350	1,223
1880	26	265	758	1,687
1881	32¼	281	953	2,120
1882	41¾	394	1,244	2,765
1883	48	454	1,358	3,350
1884	51½	517	1,527	4,035
1885	62	597	1,914	4,883
1886	75	754	2,629	6,263
1887	90	812	To Oct. 1	....

The pumping machinery at first had a capacity of about 5,000,000 galls. per day. This was increased from time to time till it reached 14,000,000.

The new works at Quindaro, and the change of supply from the Kaw to the Missouri river was decided on early in 1886, and work commenced in April of that year.

The Quindaro works are for supply only. The pressure required to force water to all parts of the cities is given by the present pumping works at Turkey creek, the new pumping works at Kaw point and the Wyandotte Water-Works, having together a capacity of 24,000,000 galls. per day. They are supplied by the works at Quindaro, having an equal capacity, the present use of water averaging about 10,000 000 galls. per day. There are two pumps made by the Holly Manufacturing Co., Lockport, N. Y., each with a daily capacity of 12,000,000 galls. They were built from designs made by Mr. G. W. PEARSONS, Chief Engineer, and are specially designed to deal with muddy water. The reservoir is divided into 4 basins, and has a capacity of 60,000,000 galls.

Water enters the center basins first and flows through all the rest to the outlets of the last basin; from there it enters the 36-in. main and flows to Kaw point by gravity, the basins at Quindaro being high enough to give the necessary flow. This line is 3½ miles long.

At Kaw point the water is received in an iron tank 50 ft. in diameter and 24 ft. high, the use of this being to equalize the flow in the long lines at Quindaro. At Kaw point part of the water is used by the new 9,000,000 galls. Worthington pump, and the rest flows 2¼ miles further to the old settling basins, which become the storage for the new supply.

Weight of Cast-Iron Water Pipes.—The following table shows the thickness, weight and strength of pipes adopted by Messrs. A. H. HOWLAND and GEORGE A. ELLIS for standard use in ordinary cases. The smaller pipes are heavier than theoretically necessary for most places, but in adopting a standard, care was taken to have it sufficient for the majority of places met with in practice:

Internal Diam.	Thickness.	Weight per foot of cylinder	Weight per foot of pipe laid including bells.	Weight per length of pipe of lay 12 ft.	Ultimate strength when made of iron having tensile strength of 19,000 lbs.	One-fifth of the ultimate strength.
Ins	Ins.	Lbs.	Lbs.	Lbs.	Lbs. per sq. inch.	Lbs. per sq. inch.
4	0.40	17.27	18.75	225	3600	720
6	0.42	26 46	28.92	347	2515	503
8	0.45	37.33	40.50	486	2025	405
10	0.50	51.54	56.17	673	1800	360
12	0.55	67.76	73.75	885	1650	330
14	0.58	83.02	90.67	1088	1490	298
16	0.60	97.78	106.78	1281	1350	270
18	0.64	117.11	126 67	1520	1280	256
20	0.70	142.25	153.43	1841	1260	252
24	0.80	194.77	210.33	2524	1200	240
30	0 90	273.00	285.33	3524	1080	216
36	1.00	363.22	390.50	4686	1000	200
40	1.10	443.82	480.83	5770	990	198
42	1.16	491.49	532.42	6389	995	199
48	1.30	629.16	681.58	8179	975	195

The Toronto Water-Works.—Toronto, Oct. 24.—County Judge MCDOUGALL, who has been investigating the affairs of the Toronto City Water-Works, made his report to-day, finding Engineer Venables guilty of gross and culpable neglect, and that the coal accounts of the water-works, kept by Venables, have been deliberately falsified, and that fraudulent entries of coal never delivered have been made. The Judge found also that the city during three years paid for at least 1,000 tons of coal not delivered. He finds also that a pumping engine, for which the city paid $50,000 cannot do its guaranteed work, and that the so-called official tests of the machine have been fallacious.—*New York Times.*

Proposals Open.

Artesian Well.—Proposals for a 5 to 5½-in. well from 800 to 1,200 ft. deep. OLIVER SEATON, Mayor, What Cheer, Ia.

Sewer.—Terra-cotta pipe, 8-in. S. F. COREY, Village Clerk, Saratoga Springs, N. Y. Oct. 31.

Pipe and Castings.—Cast-iron water pipe, 1,000 tons of 6-in. (class B), 550 tons of 8-in. (class B), 400 tons of 12-in. (class A), 1,000 tons of 12-in. (class B); 150 tons of special castings. Delivery to commence next spring and be completed by July. WILLIAM B. SMART Chairman (*pro tem*), Water Board, Boston, Mass. Nov. 4.

City Work.—Sewers, bridge, grading, etc. T. J. NEVILLE, Clerk, Executive Board, Rochester, N. Y. Nov. 4.

Pier.—Wooden pier at foot of W. 32nd street. THE DOCKS COMMISSIONERS, Pier A, North river, New York City. Nov. 4.

Wooden Bridge.—Length, 178 ft. THE COUNTY COMMISSIONERS, Macon, Bibb county, Ga. Nov. 4.

Asphalt Roadway, Etc.—Asphaltum roadway, stone sidewalk, gravel, gutter repairs. RUFUS SAXTON, Asst. Q. M. Gen., U. S. A., Jeffersonville, Ind. Nov. 4.

Foot Bridge.—Iron superstructure of foot bridge in Forest park. HENRY FLAD, President, Board of Public Improvements, St. Louis, Mo. Nov. 7.

Paving.—Pine wood blocks (treated with chloride of zinc,) and granite blocks. HENRY FLAD, (*as above*), St. Louis, Mo. Nov. 7.

Bridge.—Iron swing bridge and one fixed span across the Oostanaula river at Rome, Ga. Plans and strain sheets to be submitted. To be erected on existing stone piers, 98 ft., 98 ft. 9 ins. and 100 ft. 6 ins. apart, center to center. W. J. GAMMON, Chairman, Road Commissioners of Floyd county, Rome, Ga. Nov. 7.

Wooden Bridges.—Two bridges: heart pine or cypress. Plans and specifications to be submitted. WM. S. BOOTH, Parish Auditor, Baton Rouge, La. Nov. 8.

Ties.—About 43,000 railroad ties, delivered at Campbellsville Junction on the Credit Valley Ry., or at stations on the Canadian Pacific Ry. JOHN DAVIS, Chief Engineer, Guelph Junction Ry., Guelph, Ont., Canada. Nov. 10.

Railroad Shops.—At Decatur, Ala. Plans and specifications on file. R. MONTFORT, Resident Engineer, Louisville & Nashville R. R., Louisville, Ky. Nov. 10.

Pipe.—Terra-cotta pipes and bends. EDWARD CLARK, Architect of the Capitol, 145 E. Capitol street, Washington, D. C. Nov. 14.

Materials.—Bricks, granite, cement, sand, broken stone, lime and yellow pine lumber. JAMES FULTON, Paymaster General, U. S. N., Navy Department, Washington, D. C. Nov. 15.

Street Work.—Grading, curbing, guttering, Telford paving, macadamizing, etc. HENRY FLAD, President, Board of Public Improvements, St. Louis, Mo. Nov. 15.

Bridge.—Iron and steel superstructure of Grand avenue bridge. HENRY FLAD, (*as above*), St. Louis, Mo. Nov. 15.

New Croton Aqueduct.—Gate-house superstructure, roof, floor system and foot bridge for the blow-off chamber at South Yonkers; on Section 9. JAMES C. SPENCER, President, Aqueduct Commissioners, 280 Broadway, New York City. Nov. 16.

Pumping Engines, Pipe, Etc.—Two horizontal, compound, condensing pumping engines, with a daily capacity of 15,000,0 0 galls. each; also 12,000 lin. ft. of 36-in. cast-iron water pipe: also building a pumping station. ANDREW RINKER, City Engineer, Minneapolis, Minn. Nov. 17.

City Hall and Market House.—Plans and specifications of brick building, cost not to exceed $40,000. THE COMMITTEE ON PUBLIC PROPERTY, Galveston, Tex. Nov. 19.

Water and Sewer System.—About 8,984 ft. of cast-iron mains and connections; about 8,380 ft. of sewer mains and connections; one iron tower. Capt. J. W. JACOBS, Asst. Q. M., U. S. A., Atlanta, Ga. Nov. 21.

Contracting.

The Empire Subway Construction Co. has been incorporated in New York by JOHN BURTON, MAURICE MARQUIS and ALLAN W. PAIGE. Capital stock, $100,000.

The American Tube & Iron Co. will enlarge its works at Middletown, Pa.

The Iowa Rolling Mill Co., of Burlington, Ia., has been organized to operate the rolling mills in that city. The capital stock is $70,000. President, THEODORE GUELICH; Secretary, E. M. WILSON; Superintendent M. C. WILLIAMS.

The Florida Improvement & Construction Co. has been incorporated at Jacksonville, Fla., to build railroads, bridges, canals, etc. The incorporators are JAMES M. SCHUMACHER, R. TYSEN and E. W. HENCK. Capital stock, $600,000.

Train Shed.—The Union Station Co., of Portland, Me., has awarded the contract for the iron train shed to Cofrode & Saylor, of Philadelphia. The work will cost from $75,000 to $80,000. The sheds will be 800 ft. long and about 100 ft. wide. Mr. M. W. WISLER is Superintendent.

Well.—At Kalamazoo, Mich., the following bids for the new well for the water-works were opened Oct. 21 by CHAUNCEY STRONG, City Clerk: W. R. Coats, Kalamazoo, $6,500; Geo. C. Winslow, Kalamazoo, $8,300; Joynes & Son, Detroit, $8,790.

Water-Works Wanted.—The Municipal Council of the village of Saint Sauveur, Quebec, intends to introduce water-works, and will be glad to meet any party or company who would examine the locality and submit a plan for a system of water-works, with the cost thereof, before Dec. 1.

Cable Railroad.—The contracts for grading the route of the Wyatt Park cable line, St. Joseph, Mo., have been awarded to Smith, Rose & Co., and T. E. Sheehan. The contracts call for the completion of the work by Dec. 1. On Lafayette street there will be a cut of 44 ft.

Flexible Water Pipe.—McRitchie & Nichol, of Chicago, have laid a 16-in. water main at St. Paul, Minn., across the river from Broadway to State St. The main has flexible joints every 27 ft., and expansion joints every 200 ft.; it is laid in a dredged trench 6 ft. below low water mark.

Pipe Culverts.—We are informed that the pipe for the culverts on the Kansas City & Omaha R. R., which were described and illustrated on page 300, was furnished by Messrs. Blackmer & Post, manufacturers of sewer and culvert pipe, St. Louis, Mo.

Wrought Iron Pipe.—At a meeting of all the manufacturers of wrought-iron pipe in this country (with one exception), held in New York, Oct. 26, it was decided to raise the present card rates 2½ per cent. on all sizes of pipe. The present great demand for the pipe was considered to justify the advance.

Sewer Work.—The following contracts for sewers at Greenbush, N. Y., were awarded Oct. 20, by LANDRETH, FITZGERALD & PRESCOTT, of Schenectady, N. Y., who are the engineers: Section 1; Benjamin Van Vranken, of Schenectady; 8, 15, 18 and 20-in. pipe laid, 12, 15, 20 and 25 cts. per lin. ft.; excavation and back filling, 22 cts. to $1.25 per lin. ft. from 6 ft. to 13 ft. deep; brick sewer $1.50 per lin. ft.; manholes, $18 each; catch basin, $25 each; 15-in. iron pipe, $1 25 per lin. ft.; rubble wall, $6; total, $2,215.70.—Section 2; John McEncroe, of Schenectady: 8, 10 and 24 in. pipe laid, 15, 15 and 35 cts. per lin ft.; excavation and back filling, 30 cts. to $2 per lin. ft. from 6 to 21 ft. deep; manholes, $20 each; catch basin, $25 each; lampholes, $3 each; flush tanks, $20 each; total, $2,081.80.—Section 3: M. N. Dunn, of Greenbush: 8, 10 and 24-in. pipe laid, 3, 3 and 4 cts. per lin. ft.; excavation and back filling, $38 cts. to $1.18 per lin. ft. from 6 to 10 ft.; manholes, $22 each; catch-basins, $30; 24-in. iron pipe, 60 cts. per ft.; rubble wall, $1.25; total, $1,869.35.—The contract for material was awarded to Jas. J. Dwyer, of Utica, N. Y., at the following prices: 8, 10, 12, 15 and 24 in. sewer pipe, 27¾, 39¼, 51½, 90½ and $2.35½ per lin. ft.; inverts, 20 cts.; brick, $6.75 per 1,000; Rosendale and Portland cement, $1.20 and $2.50; oakum, 7 cts.; limestone sets, $20; sand, $1 per yd.; cast-iron, 2.9 cts. per lb.; wrought-iron, 2¾ cts. per. lb.; water-pipe, 1½ cts.; lead, 4¾ cts.; rubble, $1.75; total, $9,523.38.

The other bidders, and their totals, were as follows: Section 1: Matthew M. Dunn, $2,904.70; John McEncroe, $3,110.50; John B. Doyle, $3,139.20; John Morrell, $3,431; Peter Finckle, $4,748.90.—Section 2; B. Van Vranken (withdrawn), $1,976,60; John B. Doyle, $2,799.15; M. N. Dunn; $2,856.40.—Section 3; B. Van Vranken, $1,980.75; John B. Doyle, $2,104.10; John McEncroe, $2,408.05; John Morrell, $2,411.50.—Material; W. Halpen (withdrawn), $9,363.40; John McEncroe, $10,171.17; M. E. Dunn, $10,420.65; W. N. Callender, $10,631.75. The bids received were on about 5,400 ft. of work to be done this fall. The total length of the system will be about 10 miles.

Railroad Contracts.—*Lancaster & Hamden R. R.*—The contract for this Ohio road has been awarded to James H. Kyner, of Colorado. Work to be commenced Nov. 1.

Powell's Valley R. R.—McDonald, Shea & Co., of Knoxville, Tenn., have the contract for 20 miles of this road.

Charleston, Cincinnati & Chicago R. R.—Maj. Adams, of Johnson City, Tenn., has a contract for the construction of a portion of the line.

Chattanooga, Rome & Columbus R. R.—The contract for the construction of the section from Crawfish spring to a point in Carroll county, Tenn., has been awarded to Lee & Co., of Atlanta, Ga. Work will be commenced in November and completed by June, 1888.

Chicago, Milwaukee & St. Paul R. R.—Langdon & Co., of Minneapolis, Minn., have the contract to build 60 miles of the extension of the Merril branch to Ashland, Wis.—Shepherd & Co., of St. Paul, Minn., have the contract for a feeder, 10 miles long, to the Valley division. It will start about 4 miles above Mather station.

Minnesota & Northwestern R. R.—Shepard Winston & Co., of St. Paul, have the contract for grading the line from Freeport to Dubuque, Ia.

Duluth & Iron Range R. R.—Shepard, Winston & Co. have the contract for an extension 35 miles long from Tower City, Minn.

Canadian Pacific R. R.—Mr. JAMES ROSS, M. Am. Soc. C. E., formerly Chief Engineer and Manager of Construction of the Mountain division in British Columbia, has been awarded the contract on the eastern extension for the line from Sherbrooke, P. Q., to Magog. The work will include a bridge over the Magog river and a trestle, 3,000 ft. long, near Easton.

Laying Water-Pipe.—At Pittsburg, Pa., the Water Committee has awarded the contract for laying 26,000 ft. of 4-in. and 6-in. water-pipe to Eugene Scanlon at 23 cts. per ft.

Loam.—The following proposals for clean loam were opened Oct. 21 by the Board of Park Commissioners, Boston, Mass.: Chas. Linnehan, 10,000 cu. yds., $1.22 per cu. yd.; C. E. Hardon, 1,000 at $1.37; Jas. J. Coleman, 10,000 at $1.39; Edmond H. Pearson, 1,000 at $1.40; Thos. F. Maney, 10,000 at $1.50; Thos. White, 10,000 at $1.70; Patrick J. Curley and John Gallivan, 1,000 at $1.74; David Hall, 10,000 at $2.35; Hugh Nawn, 500 to 10,000 at $3.50.

Levee Work.—The contract for the construction of 8 miles of levee of the Cotton Belt District No. 1, Arkansas, has been awarded to J. S. McTighe & Co., of Memphis, Tenn., the lowest of 17 bidders, for 17 cts. per cu. yd. Work commenced on the 27th inst., and is to be completed by Jan. 15. The board reserves the right of having Section 1, immediately below Helena, Ark., completed at once.

Pumping Engines.—At Lake, Ill., only two bids were received for the new pumping engines. The Holly Manufacturing Co., of Lockport, N. Y., bid $58,500 for an engine of 12,000,000 galls. capacity, and the H. R. Worthington Co., of New York, bid $64,600 for two engines of 6,000,000 galls. capacity. The contract was awarded to the Holly Manufacturing Co. Work is to be commenced at once and completed next June. It is reported that an injunction has been obtained, on the ground that proposals were not advertised for, restraining the Town Trustees from executing the contract.

Stone Crusher and Engine.—The following proposals for a steam stone crusher and engine, have been received by the Street Committee, Lancaster, Pa.: Totten & Co., Pittsburg, Pa., a Foster crusher, 5x15, $312 and engine for same, $592; 7x18 crusher and engine, $791; 9x18 crusher and engine, $920; 12x24 crusher, $750. Sheirk & Erb, Manheim, Pa., a second-hand 9x15, No. 4 Blake crusher, on wheels, $600; 20 H. P. portable engine, second-hand, $600. John Best & Son, Blake crushers, No. 5, No. 6 and No. 7, $795, $845 and $995; 10, 15 and 20 H. P. engine and boiler, $600, $800, and $1,100. Copeland & Bacon, New York, (agents for the Blake Stone Crusher Co., of Philadelphia), a No. 5, 9x15 crusher, revolving dust screen and portable engine and boiler, on skids, $1,605.70, at New York. Harrisburg Car Manufacturing Co., Harrisburg, Pa., a No. 3 Gates crusher and portable engine for $1,800. Gates Iron Works, Chicago, a No. 2 crusher and 15 H. P. engine and boiler on skids, $1,495; a No. 3 crusher and 24 H. P. engine, $2,000. The contract was awarded to the Harrisburg Car Manufacturing Co.

Bridge Contracts.—*Rome, N. Y.*—The following bids have been received by the Highway Commissioner for the Patrick bridge: Wrought Iron Bridge Co., Canton, O., $ 1,550; Morse Bridge Co., Youngstown O., $1,595; Penn Bridge Co., Beaver Falls, Pa., $1,600; Berlin Iron Bridge Co., Berlin, Conn., $1,610; King Iron Bridge & Manufacturing Co., Cleveland, O., $1,624; Groton Bridge Co., Groton, N. Y., $1,640; Smith Bridge Co., Toledo, O., $1,675 and $1,750.

Norristown, Pa.—The County Commissioners have awarded the contract for an iron bridge across the Wissahickon to I. H. Hathaway & Co., of Philadelphia.

Pottsville Pa.—The County Commissioners have received the following bids for Middle creek bridge: John W. Berry, Pittston, Pa., $410; Wrought Iron Bridge Co., Canton, O., $723; Tippet & Wood, Phillipsburg, N. J., $735; Penn Bridge Co., Beaver Falls, Pa., $765; King Iron Bridge & Manufacturing Co., Cleveland, O., $768; Nelson & Buchanan, Chambersburg, Pa., $774; Berlin Iron Bridge Co., Binghamton, N. Y., $795; Morse Bridge Co., Youngstown, O., $825.

Chattanooga, Tenn.—The Chattanooga Bridge Co. has awarded the contract for the Market street bridge over the Tennessee river to the Decatur Bridge Co., of Decatur, Ala.; work to be completed in a year.

Denver, Col.—The County Commissioners of Jefferson county have awarded the contract for a pile bridge across Clear creek to A. G. Breene, of Morrison, at $1,550.

Roseburg, Ore.—The County Commissioners have awarded a contract to the California Bridge Co., of Oakland, Cal., for a steel cantilever bridge, 600 ft. long, across the Umpqua river, near Roseburg, at a cost of $45,000. This will be the first cantilever highway bridge on the Pacific coast.

Napa, Cal.—The Supervisors have awarded the contract for a bridge at St. Helena, to the Pacific Bridge Co., of San Francisco, for $2,000.

Smiths' Falls, Ont.—The contract for the piers for the new iron highway bridge across the Rideau canal has been awarded to Barnes & Smith, and for the approaches to Mills & Corbett.

Pier.—The following proposals for building pier No. 37, near the foot of Charlton street, North river, have been received by the Dock Commissioners, New York City: Pacific Improvement Co., $69,500; John Gillies, $63,000; P. Sanford Ross, $64,490; T & A. Walsh, $67,000; I. Eugene White, $71,000; William P. Kelly, $72,000. The contract was awarded to the Pacific Improvement Co

The Davidson Steam Pump Co., 77 Liberty street, New York City (works at Brooklyn, N. Y.), has issued a new catalogue for 1887. It contains matter of importance and interest to steam users, interspersed with good illustrations of the improved steam pumps, pumping engines and hydraulic machinery manufactured by the firm. Manufacturers and others contemplating the purchase of power pumps and pumping machinery should send for this catalogue.

Filling.—The city of Galveston, Tex., which has always had to pay an excessive price for material for filling, has started an enterprise by which the city will take 100,000 cu. yds. of filling per annum at 35 cts. per cu. yd. The projectors of the enterprise will supply material at the same price to citizens. The material will be brought from the mainland, the parties interested furnishing dump cars and paying the railroads for haulage.

Steam Road Roller.—The following proposals were received recently by the Street Committee of Lancaster, Pa.: Howell & Gruger, Lancaster, a 10-ton Aveling & Porter steam roller, built in 1885 and used in Cincinnati for a short time, $4,250 delivered. Harrisburg Car Manufacturing Co., Harrisburg, Pa.; a 10-ton roller for $4,000 and a 15-ton roller for $5,000. Wm. C. Oastler, New York, agent for Aveling & Porter; a 10-ton roller for $5,000 and a 15-ton roller for $6,000. The contract was awarded to the Harrisburg Car Manufacturing Co., for $4,000.

The Union Switch and Signal Co. is putting a complete block system of signals at Binghamton, on the Erie R. R.

Timber.—The following proposals for timber for use on the Fox river improvements, Wisconsin, were opened Oct. 20 by Capt. W. L. MARSHALL, U. S. Engineer Office, Milwaukee, Wis.: W. T. Casgrain, Milwaukee, Wis., white oak timber, $50 per 1,000 ft. B. M.; white pine timber, $38; white pine plank, $35. N. S. Wight, West De Pere, Wis., white oak timber, $38 and $37.50 at Appleton and Kaukauna respectively; white pine timber, $28 and $27.50. Glenwood Manufacturing Co., Glenwood, Wis., white oak timber, $58. The contract for white oak and pine timber was awarded to N. S. Wight. The bid of W. T. Casgrain for pine plank, the only bid received, was rejected as too high.

Sewerage System and Street Railroad.—Proposals will be received Dec. 20, at the office of H. S. JOSEPH, Civil and Mining Engineer, 231 Main street, Salt Lake City, Utah, for the construction of a sewerage system for Kinney & Sourisy's addition to Salt Lake City, comprising 200 acres. Plans and specifications can be obtained at the engineer's office. A 12-in. vitrified glazed pipe will be used to convey the main sewage into a canal recently constructed, of which the Jordan river, 1¼ miles distant, is the outlet.——Bids will also be received Jan. 20, 1888, at the office of Mr. JOSEPH, for the construction of a double track street railroad, extending from the Warm Springs north to Beck's Hot Springs, a distance of 19,010 ft. An 18-lb. rail will be used. There will be 157,100 cu. yds. of filling. Plans and specifications at the engineer's office.

Telford Paving.—

QUINCY, Mass., Oct. 24, 1887.

EDITOR ENGINEERING NEWS:

The town of Quincy has just completed half a mile of Telford road, and I think it one of the best pieces of road in the United States. It is 64 ft. wide, 41 ft. roadbed. There are 15 ins. of stone; 8 ins. paved bottom, 4 ins. of 2½-in. broken stone and 3 ins. of 2-in. broken stone, 1 in. of binding, 1 in. of fine stone screenings, and 1 in. of coarse sand. This has been well watered and rolled with an Aveling & Porter 20-ton steam road roller, and it is well worth a visit from any Board of construction contemplating building new streets. The work has been done under the charge of Mr. JOHN P. PRICHARD, Superintendent of Streets, and Mr. H. T. WHITMAN, Engineer. JOHN PARKER.

Lighthouse Work.—The following proposals for the Castle Hill lighthouse, R. I., were opened Oct. 20, by Major W. B. HEAP, U. S. A., Engineer of 3rd Lighthouse District, Tompkinsville, N. Y.: William F. Wilber, Newport, R. I., (lighthouse and metal work) $8,600; D. V. Howell, New York City, $13,877; Edward Murphy, New York City, $16,380. The following proposals for the metal for the same lighthouse were opened Oct. 22: H. A. Ramsay Engineering Works, Baltimore, Md., $6,9.0; West Point Foundry Association, Cold Spring, N. Y., $4,100.——The following proposals for metal work for the Skilligallee lighthouse, Mich., were opened Oct. 20 by Major S. M. MANSFIELD, U. S. A., Engineer of 9th Lighthouse District, Detroit, Mich.: Russell Wheel & Foundry Co., Detroit, Mich., $1,580; West Point Foundry Association, Cold Spring, N. Y., $1,629; H. A. Ramsay Engineering Works, Baltimore, Md., $1,743; John Cooper, Mount Vernon, O., $3,490; Robert Dunbar & Son, Buffalo, N. Y. $7,000.

Excavation.—The following proposals for the excavation for the extension of the new Federal Building, Brooklyn, N. Y., have been received by Postmaster HENDRIX: John Cox & Co., $1,484 for excavating; for extra work, $1.75 per cu. yd.. Timothy C. Mayher, $1,980; for extra work, 90 cts. per cu. yd. Charles Lawrence, $2,000; for extra work, 75 cts. per cu. yd. Michael D lton, $2,200; for extra work, $1.25 per cu. yd. Daniel Gallagher, $2,600; for extra work, $1.25 per cu. yd. Patrick O'Hara, $2,700; for extra work, $1.20 per cu. yd. Charles Hart, $2,900; for extra work, $1.47 per cu. yd. The contract has been awarded to John Cox & Co.

Bridges, Canals, Etc.

The Tay Canal.—The new Tay canal connecting the town of Perth, Ont., with Rideau lake and the Rideau canal, has been completed. The canal extends from what is known as the Red bridge over the Tay river at Perth for about 7 miles to Beveridge bay on Rideau lake. The entrance at Beveridge bay is protected by 300 yds. of crib work on both sides of the channel, thus securing the latter from filling up. From this entrance to the river Tay there is a mile and a half of canal proper. The river level being 26 ft. above the level of the lake, two locks had to be constructed, and these are situated at the entrance to the canal. They are 132 ft. long by 32 ft. wide, the same size as the locks on the Rideau canal. They are built of sandstone quarried in the neighborhood. The distance between the two locks is about 1,800 ft., and in this portion of the canal a large amount of rock excavation has been necessary. A substantial swing bridge carries the road between Perth and Smith's Falls over the canal between the locks. Above the locks the canal channel has been cut for over a mile to the river, and solid embankments of stone and clay have been thrown up on either side. Above this cut the canal is merged into the river for a distance of 3 miles, the channel having been thoroughly excavated and dredged and a large number of rocks removed from the bed of the river. A channel with a minimum depth of 6 ft. of water now exists along the whole route. At the Perth end the work on the canal has been very heavy. The people of Perth are anxious to have the canal extended from the Red bridge further into the heart of the town, where the basin of the old canal still remains. The decision of the Government upon this point has yet to be made known and meanwhile the canal is finished according to plans. The Government engineers in charge of the work have been Mr. JOHN PAGE, Chief Engineer of the Department of Railways and Canals; Mr. F. A. WISE, Superintendent of the Rideau canal, and Mr. T. B. TAYLOR, Assistant Engineer. Mr. C. H. KEEFER has been the engineer in charge for the contractor. The contractor was A. P MACDONALD, of Toronto.

RAILROADS.

East of Chicago.

Existing Roads.—*New York, New Haven & Hartford.*—The quadruple tracking of the New York division from Williams Bridge to Mamaroneck is to be completed by Jan. 1.——New signal towers are being erected as far east as New Haven.——If the movement for an extra session of the legislature to repeal the Grade-crossing law is successful it is probable that the work which has been planned for taking out all grade-crossings will be abandoned.——It is reported that track tanks are to be put in soon on the New York Division. The committee appointed to examine new locations for the company's shops are said to be looking favorably toward North Haven.

Fitchburg.—It is again reported that the company is to gain control of the Adirondack road. Also that the Adams St. dock at Troy, N. Y., which is owned by the company, is to be rebuilt and a line of steamers will be put on the Hudson.

Boston & Providence.—Since it was known that this road was in the market for leasing, various guesses have been made as to the probable purchaser. The Old Colony, the New York & New England, and the Stonington have each been stated to be the probable purchaser, but from present indications the New York, New Haven & Hartford will secure the line and thus control a through line from New York to Boston.

Maine Central.—The survey is in progress for the extension of the Dexter & Newport line to a connection with the Bangor & Piscataquis Railway.

Cincinnati, Jackson & Mackinaw.—It is currently reported that the company intends to secure an entrance to Cincinnati by leasing the Cincinnati, Lebanon & Northern and building a short extension to connect with it.

New Projects and Surveys.—*Sandusky, Ashland & Coshocton.*—The party making the preliminary survey of this Ohio road have run the line from Sandusky to Norwalk. City Engineer JUDSON of Sandusky is in charge of the work.

Osgood & Greensburg.—A railroad is projected between these Indiana towns. The distance is about 17 miles.

Buffalo & Geneva.—The party making the preliminary surveys of this New York road are working near Corfu.

Southern.

Existing Roads. — *Warrior Coal Fields.*—This line, which is to run from Meridian, Miss., to Decatur, Ala., is now under construction by Dunn Bros., contractors, J. W. GALLUP is Chief Engineer.

Birmingham & Atlantic Air Line.—It is currently reported that this company, the Birmingham, Georgia & Florida, and the Macon, Gr Grange & Birmingham have agreed to unite and avoid the projected paralleling of each others lines.

Chattanooga, Rome & Columbus.—Two parties of engineers are completing the final location between Cedartown and Columbus, Ga.

Covington & Macon.—E. C. MACHEN has been tendered the receivership of this Georgia company, and if he accepts it the road will probably be pushed to completion at once.

Blue Spring, Orange City & Atlantic. — This Florida road is to be sold at auction soon and will probably be secured by the Jacksonville, Tampa & Key West company, who will build the extension to Tavares at once.

Raleigh & Gaston An extension has been surveyed from Henderson to Durham, N. C., 45 miles, and a second line is now being surveyed from Franklinton, 27 miles from Durham. On the first line three large bridges will be required, on the second but one. Construction is to begin on whichever of these lines it is decided to build, within 90 days.

Durham & Lynchburg.—The first ten miles of this line between Lynchburg & Rustburgh, Va., are being graded by Serpell & Morris. Surveyors are still at work on the line between Rustburgh & Durham, N. C., a distance of 105 miles. As at present located, there will be a 500 ft. tunnel at Candler's mountain and four bridges of considerable size.

New Projects and Surveys.—*Hawesville & Pellville Mineral.*—This Kentucky company has been incorporated, with D. L. ADAIR, of Hawesville, as President. It is proposed to extend the road to Hartford, a distance of 30 miles from Hawesville.

Paintsville & Licking Valley.—This line is projected to run from Paintsville to Salyarsville, a distance of 18 miles. JOHN F. HAGAR, of Ashland, Ky., is President.

Pensacola & Memphis.—The companies by this name in the States of Florida, Alabama and Mississipi have been consolidated into one. L. H. SELLARS, of Pensacola, is President, and S. N. VAN PRAAG is Secretary. The length of the proposed line is 328 miles.

Georgia.—The Senate has passed bills incorporating the following railroad companies: Blue Ridge & Atlantic, Alabama Midland, Holcomb & Hawkinsville, Jackson & Indian Springs, Dublin and Fort Valley, Eastman & Americus Air Line, DuPont, Decatur & Florida, Thomasville, Gulf & Augusta.

Roanoke & Southern.—This road is projected to run from Roanoke, Va., to Atlanta, Ga., a distance of 550 miles. The preliminary survey is nearly completed from Roanoke to Salem & Winston N. C. Col. D. T. HOUSTON is President, and E. T. FULLER is Chief Engineer.

Clarksville, Blue Wing & Durham.—A preliminary survey has been made for this road, from Clarksville, Va., to Durham, N. C., 54 miles, and a second line is now being run. Col. W. L. HOLT, of Clarksville, Va., is President.

Wheeling, Wellsburg & State Line.—This road is projected to run from Wheeling, W. Va., to Pittsburg, Pa., about 65 miles. Right of way is being secured, and the line has been located from Wheeling to Wellsburg. SAMUEL GEORGE, of Wellsburg, is President, and A. B. PAUL, Hopedale, O., is Secretary.

Southern & Western Air Line.—Right of way has been secured and surveys are in progress for this line from Shelby to Cranberry, N. C., about 90 miles, and $100,000 has been secured in county subscriptions. Col. S. McD. TATE, of Morgantown, is President, and JNO. WILSON, is Chief Engineer.

The Northwest.

Existing Roads.—*St. Paul & Duluth.*—This company was reported last summer to have several surveying parties in the field making preliminary surveys for an air line extension from St. Paul to Omaha; and it is now stated that the company has determined upon its construction.

Red River Valley.—Notwithstanding the baleful predictions of those who have continually prophesied financial disaster to this enterprise, it now seems to be on a pretty sound basis and bids fair to be in operation before the end of the season. The Winnipeg City Council voted to take $150,000 worth of Provincial bonds, about an equal amount was subscribed by citizens of Winnepeg, and MANN & HOLT, the contractors, who are pushing the work to completion, have taken $250,000 more. The Northern Pacific is to forward material in case the Canadian Pacific refuses to do so, which, however, it has thus far shown no disposition to do.

Chicago, Burlington & Northern.—The company have applied for a rehearing in reference to the recent decision of the Illinois Supreme Court refusing to condemn right of way for building a parallel track alongside of the Illinois Central from Galena to East Dubuque.

Minneapolis, Sault Ste. Marie & Atlantic.—The grading is practically finished to Sault Ste. Marie, and about 350 miles of track are now down. The docks at Gladstone, on Lake Michigan, are finished, and track is expected to reach there by the middle of November.

Illinois Central.—The Chicago, Madison & Northern has been completed from Freeport, Ill., to Madison, Wis.——An extension is contemplated to Oshkosh, Wis.

Centralia & Ste. Genevieve.—This Illinois company has filed a $540,000 mortgage to the Farmer's Loan & Trust company, of New York, and work is again in progress under Contractor F. M. GILLETTE.

Northern Pacific.—FOLEY BROTHERS, the contractors who have just completed the Duluth and Manitoba road to Pembina, Dak., are now grading along the right of way of the Duluth, Dakota & Manitoba company, it is supposed for a branch from Grafton to the boundary.

Aberdeen, Bismarck & Northwestern.—It is reported that the Minneapolis & Pacific has secured a controlling interest in this road, and will lay the iron on a portion of the line this fall; but from the relative location of the two roads the rumor does not seem very probable.

Chicago & Northwestern.—A rumor which is not very well sustained is that the company intends to build an air line extension from Redfield, Dak., to Duluth.

St. Paul, Minneapolis & Manitoba.—The opening for business of the line to Helena, Montana, which will occur Jan. 1, bids fair to cause the biggest disturbance in freight rates that the Northwest has seen for some time. The rates which the company has published to Great Falls and points east are about three-fourths the corresponding ones on the Northern Pacific.

New Projects and Surveys.—*Paducah & Mt. Vernon.*—This line in Southern Illinois is being put under contract. E. A. QUINTARD of New York City, is President, and E. C. RICE, of St. Louis is Chief Engineer.

Mississippi, Fairbault & Northwestern.—The party surveying this line have reached Gaylord, Minn.

The Southwest.

Existing Roads.—*Central Missouri.*—About ten miles of track has been laid on this road from St. Charles, Mo., west; and the line is being operated for local business. The road is graded for some distance farther, but financial difficulties have stopped construction for the present. The report that the road has been sold to the Missouri Pacific is probably without foundation.

St. Louis Arkansas, & Texas.—The stockholders have voted to increase the bonded indebtedness of the company $1,550,000; this being at the rate of $13,000 per mile on the 120 miles of new lines now building to Shreveport, La., and Little Rock, Ark.

Missouri Pacific.—An extension is contemplated from Waco, Tex., *via* La Grange, Schulenburg, Halletsville and Victoria to the coast.

St. Louis & San Francisco.—An Arkansas extension from Jenson to Mansfield, a distance of 19 miles, has been opened for business.——On the Kansas Midland road, tracklaying has begun at Wichita and is expected to reach Ellsworth on the Union Pacific, a distance of 103 miles, before the end of the year.

Chicago, Rock Island & Pacific.—Abilene, San Angelo, Albany and other Texas towns are trying to raise funds to secure the extension of this road.

East Louisiana. — Grading and tracklaying are in progress on the extension of this line from Abita Springs to Covington.

San Antonio & Aransas Pass.—Brownsville, Tex., is the most southern city of the United States. It lies south of the parallel of 26 deg. It is cut off from railway communication with the outside world, though it has a small narrow gauge railroad of its own, 22½ miles in length, running to Point Isabel, on the coast. Across the Rio Grande is the Mexican city of Matamoras, with a population of about 20,000, and situated on an uncompleted branch of the Mexican National. But even when this is finished to Monterey, Brownsville will be no nearer a communication with the American railway systems. About $100,000 has been already raised which its citizens will donate to a railroad company that will build the road. The New York, Texas & Mexican road was originally chartered to build to Brownsville but was swallowed up by the Southern Pacific. The San Antonio & Aransas Pass company are at Corpus Christi, 150 miles away, and will probably consider the Brownsville extension. While the subsidy offered to the company is small compared with the distance to be built, the population of 25,000 at the terminus, the fact that the line would be an outlet for the Mexican National from Monterey, and that the country through which it would pass is wholly without transportation facilities, seems to promise a paying business and renders probable the construction of the line.

New Projects and Surveys.—*Leavenworth & Denver Short Line.*—This project, which has its headquarters at Leavenworth, Kan., is still being boomed, and the President recently stated that about two-thirds of the sum necessary to pay for preliminary surveys had been subscribed and that offers had been received from "competent surveyors at very reasonable rates" for running the line and making estimates of the cost of construction.

Little Rock & Alexandria.—Two corps of engineers are making the preliminary survey of this Arkansas road. B. W. JOHNSON of Camden is President.

Rocky Mountain and Pacific.

Existing Roads.—*San Pete Valley.*—This Utah road is to be extended 18 miles to some recently developed coal fields. The maximum grade of the extension will be 415 ft. per mile. H. S. KEEE, of Wales, Utah, is Chief Engineer.

Northern Pacific.—Grading is in progress on the Rocky Fork & Cooke City road in Montana, and it is expected to finish about 46 miles ready for the ties before the close of the season. About 50 miles are to be added to the Boulder Valley and Bitter Root branches and lines are contemplated for next season's work to the Castle Mountain mines and to Flathead Lake.

Oregon Ry. & Navigation Co.—Articles of incorporation have recently been filed in Oregon permitting the company to construct new lines as follows: From Centerville to the main line, near Cold Spring, 35 miles; from Wallula, in a northerly and easterly direction and following the course of the Columbia and Snake rivers to Lewiston, thence in a generally easterly direction along the Clearwater river to the Bitter Root mountains, thence by the most feasible route across the mountains to Butte, Mont., a distance of about 450 miles; from Lewiston through Camas prairie to the mouth of the little Salmon, 100 miles; from Prescott northwesterly to Grange City, 40 miles; from a point on Snake river, 20 miles from its mouth, in Walla Walla county, W. T., in an easterly and northerly direction to Grange City, 40 miles; from Walla Walla *via* Mill creek and Dixey, to Waitsburg, 22 miles; from Umatilla to Prineville, with branches, following the John Day and Des Chutes rivers, to the main line, about 385 miles; from La Grande easterly along the Grand Rond and Wallowa rivers, 70 miles, with branch from the mouth of the Wallowa northeasterly to the mouth of the Grand Rond, and along Snake river to Lewiston, 65 miles.

This gives a total of 1207 miles. But in Oregon as in some other States we could name, it is cheaper and easier to file a charter for a road than it is to build it.

Arizona Mineral Belt.—The Atlantic & Pacific company which subscribed to the stock of this Arizona road under construction from Flagstaff to Globe, now contests the payment of its subscription. President EDDY, of the Arizona company has published an exhibit of the agreements which were made by the officers of the Atlantic & Pacific and will contest the matter in the courts.

Mexican National.—About 2,000 hands are now at work on the grade south from Saltillo. A large outfit of teams and tools employed on the Chicago extension of the Santa Fé has been shipped to Mexico and is now at work on the southern end of the line near San Luis Potosi.

Mexican Central.—Contractor STEPHEN HEATON who is building the division from Aguas Calientes to San Luis Potosi has about 1,500 hands at work. A large force is also at work between San Luis Potosi and Tampico under contractors PRICE & MCGAVOCK. On the Guadalajara branch about 3,000 men are at work, and 31 miles of track are laid.

Denver & Rio Grande.—The grading forces of contractors ORMAN & CROOK which have been at work on the Aspen extension, have begun work on the Ouray branch which is to be finished before the end of the year.

Union Pacific.—The contract for a joint lease of the Oregon Ry. & Navigation company's lines by this company and the Northern Pacific has finally been ratified

New Projects and Surveys.—*San Pedro, Los Angelos & Utah.*—The project reported last week as in the interest of the Missouri Pacific has been organized under the above name and proposes to build a railroad from the Bay of San Pedro to Los Angeles and thence to Utah (Salt Lake City we suppose). The company has a capital stock of $.0,000,000. The proposed mileage in California is about 275 miles. J. P. WOODBURY, of Pasadena is a director, and J. M. WILLARD, is Chief Engineer. The latter reports to us that 60 miles of the road have been located and 10 built.

Deming, Sierra Madre & Pacific.—This corporation has been chartered in New Mexico to build a line 40 miles in length, from Deming to a connection with the line recently chartered in Mexico.

Denver & Golden.—This Colorado company is making surveys along its proposed route. W. H. WILSON, of Denver is General Manager, and E. L. BERTHOUD, is Chief Engineer.